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Social capital in the community field

Ehren Dean Stover-Wright
Iowa State University

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Ehren Dean Stover-Wright

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Program of Study Committee:
Stephen Aigner, Major Professor
Vernon Ryan
Hsain Ilahiane

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This is to certify that the master's thesis of

Ehren Dean Stover-Wright

has met the thesis requirements of Iowa State University

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ABSTRACT

A definition of social capital consistent with Robert Putnam's use of voluntary organization participation is used to show participation in community development initiatives as being community social capital, and to locate the community field empirically and visually in a community development network. Network data from a 1994 Rural Development Initiative study's subsequent case studies of two Iowa towns is used. It is structured to show community social capital hierarchies using Galois lattices, from which the community field emerges. Vertical, horizontal, bridged and bonded community social capital ties within both communities are then illustrated empirically and compared in a way consistent with theoretical groundwork defining these terms.

I. INTRODUCTION

Network visualization has been applied in sociology since the nineteen thirties, when Moreno used images to reveal social patterns (Freeman 2000). Marx first used capital as a concept in sociology. The concept of capital has evolved through metaphorical extensions, until the social capital concept emerged in sociology in the late nineteen eighties.

A localized society has social capital, group participation, in the form of overlapping fields made of coordinating efforts among similar interest groups, the business field, the religious field, the educational field, the governance field, and the community development field. The fields overlap and feed one another but they have been difficult to measure. This thesis focuses on the community field, and draws on social capital literature to identify the community field and network theory to illustrate and analyze it.

Many theorists made the link between social capital and network theory (Granovetter, 1973; Burt, 1997; Frank and Yasumoto, 1998; Lin, 2001) but visualizations have often been complicated and difficult to interpret. Most network theorists have also focused their attention in the areas of business and economics, with subjects like job acquisition. Computer applications like UCINET (Borgatti, Everett and Freeman, 1999) take away some of the mathematical burden of creating visualizations, but they are still often difficult to interpret in sociologically useful ways. This is, I believe, because most measures of networks have been developed to describe the networks mathematically, like centrality and betweenness, then those descriptive values have been ascribed social characteristics. Social theory has not been developed into useful network measures. The development inevitably happens the other way around. Developing network measures from social theory provides measures with greater value in sociology.

Coleman, Lin, Granovetter, Burt, and Putnam include the existence of a network in their definitions of social capital, but network visualization lacks an acceptable way to

describe the various forms of social capital ties. Wilkinson (1970), a community scholar, has expressed the important theory of the community field, which is intuitively linked to networks. It is arguable that, though sociology has a functioning technique for visualizing network data, it is less sociological than it could be. New forms of visualization are used in tandem with traditional techniques to visually describe social network, sociologically.

Concepts from social capital literature are explored to understand what is being measured in a community field. I focus on Robert Putnam's use of social capital among the key concepts of systems, hierarchies, homogeneity, fields, generalized trust, network visualizations and concept lattices.

Robert Putnam's definition of social capital as voluntary organization participation is used so show participation in community development initiatives as being community social capital, and to locate the community field visually in a community development network. Network data from a 1994 Rural Development Initiative study's subsequent case studies of two Iowa towns are structured to show the community social capital using Galois lattices to organize participants into tiered hierarchies, from which emerges the presence of a community field. Vertical, horizontal, bridged and bonded community social capital ties within both communities are then illustrated visually and compared in a way consistent with theoretical groundwork defining these terms.

Methodology

All of the concepts are presented using data from the 1994 R.D.I. study's subsequent case study interviews. Using these data, hierarchy structures are demonstrated using lattices which inherently identify those groupings of actors with higher community social capital and the existence of a community field. A set of key theories is explored fully. Putnam's operationalization of social capital as voluntary organization participation is key to the use of lattices in showing the hierarchy of community social capital. That theory is fully examined

and all of the difficulties inherent in using it are addressed. Theories of network visualization and previously used methods of visualization are examined so as to emphasize clearly the inherent advantage of lattice structure.

Network theory and systems theory are important in understanding the value of network visualization. Networks are structures of interaction where a sociologist must measure both the actor who is making a meaningful connection with another actor and the relationship itself. Network visualization should show those actors and their relationships and allow for the measurement of the significance of those relationships. Systems theory, specifically Autopoietic systems theory (Luhmann, 1995), is a way of understanding the nature of those relationships among actors as systems of negotiated meaning where a common understanding of asset ownership is being negotiated. This is how social capital becomes an aspect of networks and makes room for the idea that group participation is a valid measurement of social capital. A full exploration of these ideas is in the next chapter.

There is a need in sociology for a way to describe concepts such as social capital visually and consistently with ethnographic observations, using ideas that emerge from social theories rather than fitting social theories into existing network models. The rich world of description available from ethnography is, at least in part, lost in traditional network visualization. The result of this thesis is a major step toward the introduction of a powerfully useful technique.

II. LITERATURE REVIEW

There is a need in sociology to be able to identify the processes in community development which explain why some communities are more successful than others at creating and maintaining a culture of community development where the population makes collective efforts for the common good. It can not be explained simply with fiscal or human capital explanations, but requires the use of theories of social capital.

The application of network analysis to understanding the workings of communities toward these purposes has forwarded the idea of the community field. The community field is an aspect of a population that serves to coordinate the social fields present in a population and give them direction toward the goals of the generalized community and to coordinate the exchange of resources among those social fields to make the best use of the resources available to the community as a whole. But, network analysis is a technique that has not developed out of a strong sociological perspective. It has grown intuitively from mathematical properties of maps created of actors and their interactions.

Community research scholars studying community development efforts have been employing techniques of networks analysis in examining social capital in communities. Sharp (1998) analyzed community action in three Midwest towns using network analysis of social capital, social fields and the community field. He showed that a community field generalizes a community's across a range of social fields. Social fields are groups oriented to a specific cause, but the community field gives a focus that spans all of the social fields. He then goes on to study communities using network analysis techniques and establish a link between the presence of social capital in the community and the ability of the community to mobilize for action.

Building on Sharp, Aignitsch (2003) studied two Iowa towns using network analysis techniques to identify the core groups of actors composing a regime which controlled the

community. She showed that community social capital is causal of citizen participation and community action. She further showed that a regime can serve as a mechanism for coordinating and directing various social fields toward community-wide interests, and so is part of the community field. She advanced the use of network analysis to identify the presence of structures in the community development sectors of towns.

Both Sharp and Aignitsch made important advancements in the application of network analysis and theories of social capital in the study of community development. They show an expectation of finding a coordinating element in a community through the use of network analysis and measurement of social capital. Sharp expressed a need to theoretically elaborate the processes of community, and Aignitsch expressed a need to explore which network features are most important in facilitating community action. I find that the lack of a fit between current techniques and the theoretical needs of community development lies in the evolution of techniques of network analysis. Because current techniques of network analysis were not developed from a community development perspective, it has been difficult to fit network analysis with the theories of community development. It is necessary to evolve a technique organic to community development to supplement or supplant current network analysis methodologies.

It is necessary to develop, out of social capital theory, a way of visualizing the presence of actors and interactions in a community if we are to understand how different communities diverge in their approaches to the process of developing and furthering the community field. The elements of this technique are (1) the functioning of social capital as community development organization participation, (2) the ties that hold together networks of social capital (3) the emergence of hierarchies from overlaps in those networks of participation, (4) the emergence of the community field where those overlaps occur.

Sociology still lacks a technique of understanding empirically, and expressing visually, the relationships that constitute the community field, and until we do we can not

effectively model change to develop toward a more effective community field. What emerges in this thesis is a picture allowing the comparison of the community fields in different towns, with social capital measures of social ties. I compare two specific communities to reveal variations between their community fields in relation to earlier measures taken in the same communities.

Defining Social Capital

Social capital is the capacity of any actor, a person or a group, to mobilize resources embedded in a network structure through social relationships (Lin 2001). It is an imminently popular concept in sociology, which Portes (2000) calls sociology's most successful recent export to other fields. In Putnam's *Making Democracy Work* (1993) he devotes a chapter to social capital. The article "Bowling Alone" (1995), and the subsequent book of the same name (2000) focused more expansively on social capital. They expressed the idea that nations vary with respect to social capital as a function of voluntary group participation. Putnam and Goss state clearly that "[w]e describe social networks and the associated norms of reciprocity as social *capital*..." (2002, p. 8). This thesis continues in that tradition, and considers the presence of social capital in voluntary organizational participation. It then shows fields (Wilkinson, 1970) resulting from the overlapping of interest-focused organizations, and considers how generalized trust arises in the community.

While social scientists agree that social capital has great conceptual value, they disagree about its exact nature and, therefore, how to measure it. The widespread use of the concept of social capital before it was fixed in theory and method caused some muddying of the concept. Since an initial burst of attention, there was a concerted effort on the part of sociologists to return it to usefulness, by clarifying its definition, filling in missing theoretical backbones, and operationalizing key concepts. They did that through a careful examination

of the uses and misuses of the concept over the last few years (Portes, 1998, 2000; Lin, 1999a, 1999b, 2000, 2001; Granovetter, 1973, 1982; Portes and Landolt, 2000).

The most popular operationalization of social capital came from Putnam. (1993, 2000) Although he explored the ideas of many theorists, Pitnam focused on Coleman, Burt, Granovetter and de Toqueville. He defined social capitlal as mobilized assets embedded in social networks which can be measured as voluntary organization participation. I explore key precidents to Putnam then use the range of theorists to explore aspects of the concept that will be relevant in the susbequernt chapters of thie thesis.

Coleman and Bourdieu

The literature provides support for the idea that participation in community-focused organizations is a source of generalized trust, and can be measured as social capital. This chapter illustrates that common participation in multiple community-focused organizations constitutes the community field as described by Wilkinson. Social network analysis is used to show the existence of a community-focused social network which is measured in terms of social capital.

At nearly the same time, Bourdieu (1983) and Coleman (1988) introduced social capital in modern sociology separately. They approached the same concept from different perspectives. Bourdieu was a nuanced Marxist, focused on conflict. Coleman was an exchange theorist. Both saw that the outcomes of an actor's social endeavors are decided by the nature of their social networks. Coleman and Bourdieu called this notion "social capital", and used it to supplement economic and human capital.

> "Social capital is the aggregate of the actual or potential resources which are linked to possession of a durable network or less institutionalized relationships of mutual acquaintance and recognition—in other words, to membership in a

group—which provides each of its membership with the backing of collectively owned capital" (Bourdieu, 1983).

Bourdieu's specified social capital as a strategy where an actor furthered their personal causes by using their social connections to access collective resources and gain position in a hierarchy. Bourdieu suggests cultural capital, a concept related to social capital, as the particular positioning of an actor in the hierarchy of hegemonic power. Actors do this by resembling a generally accepted norm, which is advantageous in gaining other forms of capital (Bourdieu, 1983).

Coleman first published the modern idea of social capital in English and was quite influential in its subsequent development. The concepts of social capital held by Coleman and Bourdieu are, in a way, separate ideas sharing the same proper name. In another way they are asking the same basic question. How do social scientists explain what can not be explained by human and economic capitals? Bourdieu's answer was to focus on positioning of actors in hegemonic power structures. Coleman embarked on the formation of a grand unified theory of social systems.

Coleman's theory begins with rational exchange among dyads. Trust is at the core of any dyadic exchange, according to Coleman's theory. The first actor exchanges control of his own decision for control of the other participant's decisions. It is then possible to have perfect trust. By adding more actors, groups form. They enforce their will through the use of rewards and sanctions. Norms reduce the need for groups to expend resources enforcing sanctions, as people voluntarily internalize the group's goals as their own. This leads to homogenization and hegemonic rule. Social capital measures the value of group participation in Coleman's Social Theory. He builds on works by Lin and Granovetter to examine social capital as a system of network relationships explaining why some actors make decisions inconsistent with neo-capital rational exchange models.

Coleman maps out simple network systems where human capital is represented in the actors and social capital is in the relationship among the actors. Using those relationships, another actor's capital can be mobilized by the ego-actor through the social capital of the network relationship. These systems are specific to an outcome, so they may be useful for a one purpose and useless in another. Coleman uses social capital to supplement other forms of capital (Coleman, 1990).

Putnam

Robert Putnam's model of social capital describes group behavior by drawing heavily from Coleman's "Social Theory" and Alexis De Tocqueville's description of how organizational participation is a cornerstone of participatory democracy, and thus organizational participation represents social capital. Putnam (2000) gathered extensive evidence that social capital declined and re-emerged in modern America. He is at the forefront of social capital research positing the operationalization of social capital as voluntary organizational participation in a network structure.

> "Social capital [is] social networks and the norms of reciprocity associated with them..." (Putnam and Goss, 2002).

In this thesis, social capital is measured in two Iowa towns by showing vertical, horizontal, bridging, and bonding ties within each community as aspects of the community field. First, I explicate the meaning of social capital by examining the concepts of links, hierarchies, fields and culture. In this case the focus is on community development culture, but the methods of measurement employed here are generalizable to any culture.

Social Capital in Relation to Previous Forms of Capital

Social capital theory developed out of a tradition emerging from Marx's (1977) classical capital theories where surplus value relative to cost of production is returned to the owner of production. The system of capital investment and return is still at the core of exchange forms of neo-capital (human, social, and cultural). The major changes involve the nature of the investment and the investor, so it is acceptable to consider it as to be a form of capital. Social capital is conceptualized as something to be exchanged (Lin, 2001).

In classical capital, laborers had no agency, power, or potential to act within the system. As long as they were paid enough to live on, anything they produced in excess of their sustenance went to by the owner of the means of production. It was a visionary way of seeing social control as part of economic production, but it explained only a small part of observable reality (Lin, 2001).

Classical models of capital failed to explain how some laborers, both in and among industries, received more or less pay than others. If costs of production are determined by sustenance then there should be no differentiation.

Capitalists saw that some skill sets, training and experience were valuable. Some laborers were more valuable than others due to their characteristics, and they demanded better rates laborers without those attributes. In neo-classical capitalism, trading attributes for a portion of excess value is referred to as human capital. Human capital introduced the worker-as-agent into the capital generation equation (Lin, 2001).

The complexities of human capital are many, and they explain much, but alone they do not explain everything. Coleman in America in 1988, and Bourdieu in France in 1983 (translated to English in 1986) both tried to address questions about how people with the same human capital could demand differently in the market. The answers were cultural capital and social capital (Lin, 2001).

Cultural capital is the symbolic imposition of norms on society by the elite. It forms a hierarchy of resemblance to the cultural ideal, where the recessive classes internalize the desires of the dominant classes as their own. The individuals who most effectively do this have the most cultural capital and can use that to leverage more favorable outcomes. A person who shares the values of the dominant class can use their cultural capital to access resources to which they would not otherwise have access. They can offer reassurance, through culture, of the dominant class' socially grounded rights to resources. This is a very 'rational exchange' based view of the world, and gives actors little agency, only proficiency (Lin, 2001).

Agency is introduced to actors through a network model because they choose patterns observed from the past, imagine possible futures and devise paths to follow in attaining the most desirable of the outcomes they can envision. Mobilization of network structures is often called planning (Emirbayer, 1998).

Different forms of capital were developed in response to the shortcomings of the classical model of capital's failing to incorporate the presence of social forces. It is necessary to embed capital in a social system and so to have other medium of exchange. (Albritton, 1995).

Social capital does not consist of metaphorical extensions of previous forms of capital. It is not the direct mobilization of assets. It is a series of processes for mobilizing resources not held by the actor. It shares that core quality of resource mobilization, but is in fact not itself a resource (Bankston and Zhou, 2002). This begins the idea that social capital, for empirical purposes, is a series of, sometimes exclusive, often related, hierarchies. Social capital exists in the relationships themselves and emerges, dynamically, from the structure of the social order.

How Social Capital Works

There is some debate over how social capital works depending on the focus of study. Social capital is sometimes defined as resources embedded in a social network. Those resources are mobilized to enhance desired outcomes through four key operations of control; (1) control of flows of information, (2) control of agents in the network, (3) control of credentials, and (4) control of reinforcements of identity and recognition. Most theories of social capital agree on this basic definition (Lin, 2001; Portes, 2000).

That functional definition of social capital makes it an investment with expected returns for the actor. As an asset of a collective asset, social capital is based on a group making an investment to enhance its members' life chances. Repeated internal exchanges reinforce collective ownership of certain assets to be used as leverage in interactions with other groups (Lin, 2001). Group expectations enforced through norms allow an actor to expect help from the group during endeavors involving agents from outside the group. Social capital is common to the group and an actor cannot take it with them. When an actor vacates a position, social network resources stay in the group, however the group as a whole may be reduced by their absence and whatever *economic* or *human* capital they take with them (Flap, 2002; Coleman, 1990).

When actors interact, they trade social capital constantly through the negotiation of meanings. That negotiation sets up a hierarchy of legitimate claims on the assets embedded in the structure of the network. Actors with the most legitimate (most recognized) claims have the best positions in the hierarchy. What is being negotiated in the trade is recognition of that legitimate claim on the asset. In exchange, the actor with the most assets and legitimacy recognizes the lesser actor in exchange for recognition plus something else. What that something else is depends on the imbalance and nature of the exchange for another asset in a greater or lesser amount based on position in the relevant hierarchy (Lin, 2001).

Reciprocity is the idea that there must be a balance of exchange in the trade. The higher position actor is willing to recognize the lower position actor's claim on a given asset in exchange for something. Typically, the first element of reciprocity is legitimization of the hierarchy (Lin, 2001). In any system of unequal rational exchange, the less powerful actors must offer resources in exchange for recognition of control over their remaining resources. The inequality must increased as a result of the process of recognition. If no other factors are present, all wealth will eventually concentrate in the top of the hierarchy as a sort of systemic default. Irrational behavior leads to lower level gains in capital exchanges and of social capital (Coleman, 1990).

Simmel (1955, p. 131) observes that rationalization of society harms natural relations. High density familial networks, natural relations, and their near extensions are the most *frequent* sorts of interactions. They are most important in establishing the bulk of common meanings. These relationships, which Lin (2001) calls the initial position, are the most telling of where an actor's efforts will lead. Exchanges in familial groups often contradict expectations of rational exchange models, but those relationships serve as the foundation for the development of social networks.

When resources embedded in a network are mobilized, it is for a specific purpose. The value of the resources is determined through a negotiation of meaning, which is a process of rhetorical discourse among the actors involved in the exchange, and is heavily influenced by the purpose for which the resources were mobilized (Luhmann, 1995; Burke, 1969; Lin, 2001).

A hierarchy emerges. Higher position goes to those with access to the more valuable and heterogeneous resources. Actors with resources acquire power, allowing still greater access to resources. There is, then, a tendency to act on behalf of the larger group to

maintain the differential access that comes with power, which is the prime theorized motivation for action (Lin 2001). The further implication of this is that a community field[1] consisting of a single group representing the full range of community focused interest groups should be able to act in the best interest of the community while coordinating its divergent elements.

Hierarchies tend to have fewer actors and more resources at the top than at the bottom. Power holders control positions of power and authority beneath themselves. According to Lin (2001), these hierarchies form in the three major realms (1) socio-cultural, (2) economic and (3) political. (See Table 2.1) They can be seen as either positional distributions in groups, in which case they are (1) status, (2) class and (3) authority, or as individual holdings, in which case they are (1) reputation, (2) wealth and (3) power respectively. This gives *a lot* of motivation for maintaining position in the hierarchy. Within each of these realms, hierarchies form for each differential resource within the larger network (Lin 2001).

Table 2.1 - Major categories of hierarchies (Lin 2001).

	Socio-Cultural	Economic	Political
Groups	Status	Class	Authority
Individuals	Reputation	Wealth	Power

Many social capital theorists advocate measuring social capital as an aspect of a specific domain (Snijders 1999) existing in a network structure. In this case, it is useful to measure the community field, the upper aspects of the community development hierarchy, because community social capital is specific to those group's assets. For instance, community development groups could be measured to produce the community domain, or field.

[1] A community filed coordinates and focuses the direction of the efforts of the various social interest foci in the locality. The nature of the community field will be elaborated on later in this chapter.

Ties

After measuring the actors and their relationships, the sociologist can determine the centrality of actors, the density of the network, the presence of holes in the network structure and the nature of the ties that bind the actors. Common dichotomies of ties are bonding and bridging, horizontal and vertical, and strong and weak. These combine with actor measures to create dualistic or 2-mode data (Portes, 1999a; Lin, 2001). Size or degree, density, heterogeneity or homophily, compositional quality, closeness, betweenness, average or maximum distance and centrality are common measures of the actors in networks (Borgatti, Jones and Everett, 1998).

All ties are contextual to the defining characteristics if the groups or the hierarchies of which they are members, i.e. political ties are separate from economic ties, though they may be related.

Bridging and Bonding

Bridging versus bonding is a frequently encountered dichotomy of ties. Bridging ties are ties between participants from separate clusters. Bonding ties connect participants within a group, and contribute to homophily (Putnam, 2000; Lin, 2001). The importance of bridging social capital becomes more important at hierarchical levels where lower population group exist (Burt 1997).

Ties dissolve and change, but systems tend to be persistent over time once established (Rice and Ling, 2002). Burt (2002) shows that, while critical to acquiring social capital, 9 out of 10 bridge ties disappear after one year, four times quicker than the rate that bonding ties dissolve. After a year the rate of decay of all sorts of ties drops significantly and quickly becomes near zero. It is likely that this is because the cost of maintaining a bridge is born by

a single actor, within each group, at either end of the bridge. Also, most benefits of bridge ties are realized quickly, negating the value of maintaining the relationship.

Weak and Strong

Burt (2002) shows clearly that bridges can be either weak or strong. This makes sense, and it may even be that strong ties, but not gemeinschaft ties, are more common bridges because the cost of interacting across bridges is high and both parties are likely to maximize frequency and intensity to gain the maximum benefits up front. Also, once established, a decayed bridge may have very little cost to rebuild which makes the cost of allowing decay negligible.

The strong versus weak dichotomy of network ties embodies the idea actors relate to each other with varying intensity. This is often measured by frequency of interaction. These relationships can be the ones across which the most social capital flows, receiving the most intensive attention while they are active, and which are often ended and held in limbo once the actors' social needs are met..

Granovetter (1973, 1982) supposes that weak ties are necessary for personal fulfillment and social cohesion and often carry the most useful information. Weak ties allow groups to have stability, yet take advantage of resources not available in their local group (Freeman 1992). Strong ties carry intra-organizational information where weak ties carry inter-organizational and extra-organizational information (Friedkin, 1982).

Vertical and Horizontal

The vertical versus horizontal ties dichotomy is the necessary result of a hierarchy. Horizontal ties connect actors who hold similar positions in that hierarchy, i.e. they exist within the same hierarchical level. Vertical ties connect actors of different levels. Morgan and Sorensen (1999) show that dense vertical networks lead to social capital, though density

(common interconnections among a set of actors) is less likely to occur across levels of a hierarchy. Horizontal Ties are more gemeinschaft-like and vertical ties are more gesselschaft-like (Warren, 1973).

In this thesis, ties are among actors within the locality where the data were gathered. This is most important in the vertical versus horizontal ties dichotomy, because the term "vertical ties" is often used to refer to extra-local ties, assuming that connections reaching outside of a locality move upward in a hierarchy. In this thesis hierarchies are specified and vertical ties are those ties that cross levels of hierarchy within the community.

Hierarchies in Networks

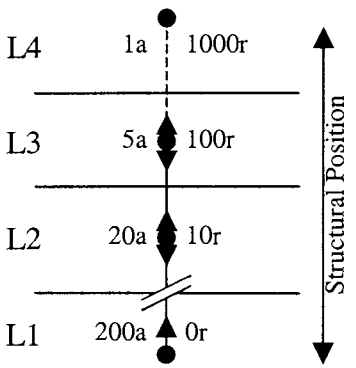
Hierarchies emerge from unequal exchange in networks (Lin, 2000). They result in all sorts of inequality, depending on how that lack of equal access is settled among actors making exchanges for recognition of assets.

Hierarchies are collections of actors arranged by levels with similar command of assets and access to resources. Though parallel hierarchies can be considered, each hierarchy of social capital must be specific to a single sort of outcome based asset. For example, a hierarchy of access to social capital for committing white-collar crimes would be different than a hierarchy of social capital for committing street crimes. Existing in the same population, some actors would occupy both hierarchies, but with different positions in each hierarchy. Interest group participation would reveal an organizational structure, a criminal field, in the larger community (Lin, 2001).

A useful model of a hierarchy shows four measurable qualities; (1) the number of levels of differentiation within the hierarchy, (2) the distribution of occupants, (3) the distribution of the assets, and (4) the sum of occupants and resources within the hierarchy (Lin, 2001). These four factors can be compared within a population.

Figure 2.2 is an illustration of a group with four levels of hierarchy. It expresses of all the important factors Lin (2001) described. A number followed by the letter "a" (actor population) expresses the population of each level. A number followed by the letter "r" (resources) expresses the access to resources of each level. Access to resources is constant within a given level. Multiple visuals would allow consideration of access to different resources within a population. L4 has the most power to distribute jobs. The lower levels

Figure 2.2 – Simple Hierarchy



have lesser power. L3, perhaps, has the ability to hire and fire with approval of L4. L2 can recommend to L3. L1 has no power and is not consulted during decision-making processes.

Fields

Burke (1969) described a system where one person can exist in multiple groups simultaneously, by holding multiple selves. This is an idea that exists in meso-level network theories, like the one used by Sharp, Flora, and Killacky (2003) where the actor is the group and the connection is the existence of the same individual in multiple groups. On a micro level, where we look at individuals as the actors and connections are interactions, the common methods of network visualization fail to capture the existence of a single person in multiple groups, forcing the use of bridges and restricting individuals to one side of the bridge or the other. However, there are network level theories of fields that do allow a single person to exist in many different fields. For Sharp, Flora and Killacky (2003), at the meso-

level, the person *is* the bridge, a strategy that sidesteps the measurement of the nature of relationships and allowing the qualities of the individual to *be* the connection.

Wilkinson (1970, 1999) said that society is a network for meeting common needs as well as for expressing common interests. The intersection of a society's common interests is a field. The field can span multiple actors and multiple fields can cover a given actor, bringing them together with other divergent sections of the larger society. Fields are unbounded (uniquely focused), dynamic (changing) and emergent (governed by parts and their interaction.

Wilkinson's field theory shares a lot of characteristics with Emirbayer's vision of *trans-actional* sociology. Society is emergent and contextual so elements of society emerge dynamically from other aspects of society. Fields emerges from the interaction of groups whose interests are similar, as actors emerge from interactions of reciprocal trust. Fields require that the actors have similarities, but also that they interact to focus their efforts and mutually define the meaning of their actions. The bundles of communication that emerge among them are measured to reveal culture. (Emirbayer 1997: 295-301)

Gaventa (1980) furthered this idea to include the notion that fields can be distinguished by what value (meaning) they put on an asset. If two fields value an asset over which they share some dominion differently, then conflict develops. Value differences are common - one group or field values the *use* while the other considers its value in *exchange*. The group that focuses on *use* value could be said to have a more gemeinschaft-like nature as opposed to the exchange groups gesellschaft-like nature, as Tönnies said that exchange is the core of gesellschaft (2001)

Ties in Fields

Connections among actors often are characterized as being vertical, horizontal, bonded or bridged. These terms mean quite specific things. Vertical connections and horizontal connections are specific to the hierarchy in which the actors are participants and refer to relationships, in the first case, being between participants of different levels of the hierarchy and in the later case, of the same level. Measuring bonded and bridged ties require first that groups be identified, then bonded ties are among actors with the group and bridged ties connect actors in separate groups.

When ties are measured between groups (groups are the actors in this case) the connections are individuals who are participants in both "actors". Group solidarity is measured by *closure*. Closure, within the group-actor, is the percentage of possible connections among individuals being realized. In this case, the nature of the associations among the individuals who constitute the group determines the measured nature of the group. The group can be formal or informal. For instance, individuals coming together for the purpose of performing a community service are measured as being community service group. If they have a structure, like a named adopt-a-highway program, they are formal, but three people getting together on occasion to clean up a neighborhood park constitute a group as well.

Fields are collections of groupings of actors where the actors are similarly focused (interest groups), where the individuals from interest groups who serve a focusing and coordinating function emerge from the mass to become the, in the case of this thesis, *community* field. The strength of the community field depends on the presence of dense bridging among the groups that constitute the community field within the society.

The community field is made up of interest groups, people acting together toward an interest-focused common end. Wilkinson (1999) said that "from the interactional perspective, the mechanism that links the various fields of community action in the local

society, and the central object of the study and practice of community development is the community field." (p83) He continues, "The actions in this field serve to coordinate other action fields, organizing them more or less (through an unbounded, dynamic, and emergent process) into a whole." This coordination process is a generalization of the more specific interests of the organizations themselves and can have a more informal nature. So, to locate the people and organizations that serve this coordinating purpose is to locate the community field. It follows then, that the healthier and more robust the community field, the more likely the community will provide for the well-being of its residents, regardless of ascriptive differences. The community field focuses otherwise divergent groups toward an overall direction. It allows the groups to rely on each other's complimentary strengths and to compensate for their weaknesses in a nearly sentient manner.

Network Level Measurement

Network level measurement is the process of measuring variations among actors and the relations they have with one another. This usually means finding out who knows whom and in what capacity they interact. Typically this entails grouping people into clusters of mutual association, or by purposive action into fields. At a micro level, outcomes affect individuals in small groups (Lin, 1999b).

Social capital often is thought of as flows among groups, which can be seen as individuals interacting between groups (Lin, 1999b). Simmel (1955, pp. 132-139) told us that one person may coexist in multiple separate groups. This causes tension leading to the creation of a superstructure of rational (businesslike) associations dominant over natural (familial) affiliations. Then, there emerges an array of group affiliations. A person is affiliated with an array of groups, each of which treat that person as if their member-status dominates their individuality. The group affiliation further places the individual in contact with other groups; the individual becomes the point of intersection among divergent group

affiliations. Further, a person's voluntary and naturally occurring group affiliations (both gemeinschaft and gesellschaft) influence heavily upon their individuality, moving affiliated groups toward homogeneity; this is homophily.

This model of group affiliations gives early credence to the model of group affiliation measures Sharp, Flora, and Killacky (2003) use when they measure inter-group leaders as actor-based links between groups in communities. People who exist in multiple groups simultaneously constitute the bridges that link groups. There are individual measures used *within* groups to determine group assets, such as density, which is the interconnectedness of the people who form the group, but the group-unit makes people into assets.

Voluntary Association Participation

Assets exist in intra-society ties that exist on inter-group levels within the society, commonly measured as voluntary group participation (Lin, 1999b). Putnam (1993, 1995, 2000) operationalizes social capital as an asset of macro level groups which he then measures as citizens' participation in voluntary organizations. This approach has become prolific and widely applied.

A lack of theoretical linkage between voluntary group participation and social capital is the most common complaint people have had about Putnam's work, though his empirical measures have been roundly praised as exemplary empirical science. Portes (1998), commenting on Putnam, shows that he risks a tautological argument with his model; working together (voluntary-organization participation) is causal to social capital, which in turn is measured via voluntary group participation. Measures of participation reveals what emerges from the actors and their interaction, relative to their starting point. Actors *interacting* in a system, measured as particular groups' active participants, indicate perpetual emergence rather than circular causality.

Gamm and Putnam (1999) follow Coleman in his contention that sanctions and rewards are primary motivations for complying with norms, and show that homogeneity encourages voluntary group participation, thus forging a link in theory between voluntary-organization participation and social capital (as norm enforcing) and answering Portes' (1998) complaint that the relationship between social capital and voluntary group participation has not been sufficiently theorized.

Gamm and Putnam (1999) acknowledge that this is a phenomena which theoretically should be found in small populations and doesn't explain the raise of participation among urban populations. However, large heterogeneous communities offer more opportunity for participation in groups that honestly reflect the desires of the participants to join voluntary groups, but less sanction based incentive to do so. This is the only theoretical weakness that Gamm and Putnam (1999) acknowledge, but using homophily (Lin 2001) effectively explains it.

When Hunter (1983) takes on this issue, he shows that urbanization does not necessarily carry all the negativity of homogenization that is frequently theoretically linked to it. Due to a tendency for people to cluster within population centers, there is a sense of connectedness maintained, though he goes into a great deal of eloquent description of how this happens through the four stages of community (residual, emergent, conscious and symbolic) where a process similar to homophily allows the individual to feel connected without the need for frequency of interaction to be maintained. For Putnam this is useful because it allows any city to be treated as a cluster of smaller population units. This makes the theoretical link between voluntary group participation and the presence of social capital complete.

Leonard and Onyx (2003) supplement this idea by suggesting that a high social capital society could be modeled as a chain of well-bonded (micro or internally) groups with a high density of strong links among the groups (making the leap to macro level). It becomes

a macro-density measure, akin to Freeman's (1977) micro density measures, and makes a gross social product (G.S.P.) possible for higher-level groups. This model of social capital keeps constant measures across levels.

Accepting the operationalization of social capital as voluntary organization participation, interactions keep social capital 'flowing' and expectations of reciprocity are more easily met through frequent interactions (Lin, 2001). This does not necessarily mean that frequent interaction alone will lead to relative equality among societies. A society's history and starting point are the most important factors in determining the outcome of investment in social capital. A society with a preexisting stock of resources has more time for engagement in organization-forming activities and the exchanges of social resources within that society. If that stock of resources was historically siphoned from another society, the relative advantage in multiplied, and the disadvantage felt by the other society is more acute. The exploits of the past continue to reap great rewards.

For the purposes of this thesis, based on the evidence presented here, I will conceptualize interest group's overlapping participation as the community field, and the location of the community social capital. The assets of the field are the assets of the network's connections, measured as those people who are participants in multiple voluntary community oriented organizations.

Hypothesis Statement

This research demonstrates a positive connection between bonding community social capital, as indicated in prior work with these data, and all sorts of social capital indicative ties within a community field. Visualization of this is done with member lattices, a new method developed on strong foundations in the literature. The question used to illustrate is, do communities with greater bonding capital (as previously determined in other analysis of the same data) possess a more functional community field, one with higher quantities of various

forms of social capital? Meadville was determined to have higher bonding community social capital than Hillside during an NRI study, using data from an earlier RDI study, which will be described in-depth in chapter three of this thesis. The term "bonding community social capital" comes from, and is specified in, that study. The term "bonded ties" is a term used in chapter four of this thesis. The similarity between the terms is unfortunate, but no substitute term is appropriate.

H1 The community field of a community with higher bonding community social capital (Meadville, as determined in the NRI study) will possess greater **bonded** ties (as determined in this study) than the community field in a community with lower bonding community social capital (Hillside, as determined in the NRI study).

H2 The community field of a community with higher bonding community social capital (Meadville, as determined in the NRI study) will possess greater **bridged** ties (as determined in this study) than the community field in a community with lower bonding community social capital (Hillside, as determined in the NRI study).

H3 The community field of a community with higher bonding community social capital (Meadville, as determined in the NRI study) will possess greater **horizontal** ties (as determined in this study) than the community field in a community with lower bonding community social capital (Hillside, as determined in the NRI study).

H4 The community field of a community with higher bonding community social capital (Meadville, as determined in the NRI study) will possess greater **vertical** ties (as determined in this study) than the community field in a community with lower bonding community social capital (Hillside, as determined in the NRI study).

III. METHODS

The Data for This Thesis

An RDI study of 99 rural Iowa towns with populations between 500 persons and 10,000 persons was conducted in 1994. One town from each of Iowa's counties was selected by a stratified random sampling procedure. The response rate was 73%.

Bonding capital was measured using residents' assessments of their connections to other residents (density of acquaintanceship), the trusting nature of the community (trust), and the extent to which people in the community work together (norms of collective action) (Agnitsch, 2003).

Table 3.1. Descriptive Statistics, Scale Items, Reliabilities (N=99) reprinted from Agnitsch, 2003 by permission

	Mean	S.D.
Acquaintance Scale Items (Reliability=.65)		
If I just feel like talking, I can find someone in Community to talk to	4.03	.84
What proportion of the adults living in Community would you say you know by name	2.73	.96
About what proportion of your close personal adult friends live in Community	3.68	1.15
Scale Mean & Standard Deviation (Factor Scale)	.00	.35
Trust Scale Items (Reliability=.79)		
Unfriendly/Friendly	5.55	1.30
Indifferent/Supportive	4.94	1.47
Not Trusting/Trusting	5.16	1.39
Scale Mean & Standard Deviation (Factor Scale)	.00	.20
Norms of Collective Action Items (Reliability = .86)		
Indifference about the community	1.98	.76
Failure of people to work together	2.17	.70
Loss of community spirit	2.18	.76
Scale Mean & Standard Deviation (Factor Scale)	.00	.26

Factor scales were created for each measure. See Table 3.1 for full wordings of the questions used to develop the scale. The trust scale (alpha = .79) and the norms of collective action scale (alpha = .86) had high reliability. The network of acquaintanceship's reliability was lower. (alpha = .65) Individual residents' scores were aggregated and summed to create a community level mean called "community bonding capital" (Agnitsch, 2003).

Towns were ranked by community bonding capital on a graduated scale where the top 25% had high levels of bonding community bonding capital and those in the bottom 25% had low measures of the same. Towns with high relative measures of community bonding capital were shown to have a citizenry that trusted one-another and worked well together; low community bonding capital towns scored lower in these areas. Two towns were selected, one each from the top and bottom quarter of the ranked scale, to participate in an in-depth, NRI funded, study of their community development sectors in 1997. Jan Flora, Neil Flora and Vern Ryan were the principal investigators. (Agnitsch, 2003).

Meadville was selected from the top quartile. (ranked 23rd) In 1855 Meadville was founded in a part of south central Iowa isolated from transportation corridors. The town has always faced difficulties associated with its location, taking four years for Meadville to be added to stage coach routes and another twenty years to gain railway access. Meadville is still an agricultural economy, and with the railroad gone and no major highways leading to town, it faces a struggle to maintain services. At the time of data collection it had approximately 1,800 citizens (Agnitsch, 2003).

Hillside (ranked 98th) was selected from the bottom quartile. Hillside was founded in 1867 at the intersection of major and regional railroads in west central Iowa. It quickly flourished as a commercial center of rail-oriented businesses, but eventually the railroad declined and farming difficulties had their impact. Still, the railroad persists and Hillside is located on an interstate highway and a major U.S. highway, allowing it to support its

infrastructure and some amenities. At the time of data collection it had approximately 2,800 citizens (Agnitsch, 2003).

These two communities were selected for similarities in demographic and ecological qualities, and their divergence in level of bonding community capital. Both are similar in terms of population, education, and residential stability. They differ in terms of population within a twenty-mile radius. Meadville has about 13,000 people in a 20-mile radius and is isolated by about 90 miles from the nearest metropolis. Hillside has about 151,000 people in the same area and serves as a bedroom community for a nearby metropolis. They also differ in median family income, percent of elderly population, and percent of population who work in the community or county. Despite these differences, both cities are self-sustaining communities with a local business base and similar governmental structures (Agnitsch, 2003)

Residents involved in community projects served as key informants for data gathering. Key informant interviews served to identify locally based projects focused on the public good occurring within the past three years. The process identified 7 projects in Hillside and 7 in Meadville. Meadville projects had an orientation toward the social well-being of local residents, while Hillside projects tended to be oriented to economic development and community growth (Agnitsch, 2003).

Key informants identified initial interviewees. Snowball sampling was used to select further participants for the study. Each interviewee provided at least two other local residents in the community who were "actively involved" in the project, where active involvement meant others in the community would recognize their association with the project. Respondents could claim participation in up to three projects and nominate others for multiple projects, but to be considered active the person had to both acknowledge their participation and receive nominations from others (Agnitsch, 2003).

Semi-structured interviews were conducted with 70 of 99 nominated participants in Meadville and 46 of 66 nominated participants in Hillside. Then, respondents were asked to

complete a survey of demographics and key questions from the 1994 survey, for comparison of project participants and the general population of the communities (Agnitsch, 2003).

What is important to this thesis is that within each community, each person was asked to name up to three community projects (voluntary participation organizations) with which they were involved. Then they were further asked to identify any other people who were also involved in those named projects, and that the findings were exhaustive within each community.

Network Data

Just as money is a metaphor for material contribution to the economic system, social capital is a metaphor for social contributions. Values of social assets are not fixed and actors mat reciprocate to a different group-participant than the assets were received from. All things in the system are relative to the limited social universe of the actors involved. Social network analysis is the study of those social connections allowing for the existence of such a system. Social networks are made of actors and the ties among them. Within those networks investigators study the aggregations of actors and the movement of resources.

> "Social capital is the aggregate of the actual or potential resources which are linked to possession of a durable network or less institutionalized relationships of mutual acquaintance and recognition—in other words, to membership in a group—which provides each of its membership with the backing of collectively owned capital" (Bourdieu, 1983).

Network analysis measures actors and relationships among actors. Analysis reveals a system and the value of group participation. I analyzed the relational data using traditional techniques using UCINET, a computer application designed to analyze network data. Then I

fitted the data to a lattice structure and analyzed it for the existence and nature of a community field.

Because the data set contains all of the community development projects in each of the two communities, the data comprises the relationships among all of the participants in the community-focused interest groups present in those communities at the time. The coordinating element of those community-focused interest groups is the community field.

Network data have a few common measures, which are best expressed using visualizations, pictures where points represent actors and lines represent connections. The data must be structured to reveal relationships among participants in a group or between participants in two elements within a group, i.e. individuals and groups expressed as participation.

Structuring Network Data

There are four ways to model the network data that were gathered for this thesis. The analysis in chapters three and four were done on nomination-data structured in a two-mode binary model.

The variables on the X-axis and Y-axis determine whether the data is one or two-mode data. If the variables on the X-axis and Y-axis are different then the table contains two-mode data. If the variables of both axes are the same then the data are one-mode data. The data entered in the cells of the table may either be binary or weighted. In binary network data, one indicates a relationship exists and zero, or an empty cell, indicates than no relationship exists. If the data is weighted, zero indicates no relationship and higher numbers indicate more of a relationship.

The data for this thesis tells which actors were nominated, both by themselves and by others, as being actively involved in up to three (3) community development projects. As a starting point I had data with actors on the X-axis and nominations on the Y-axis. All of the

actors represented on the X-axis were also represented on the Y-axis, as potential nominations, but the names represented different variables. A binary value is entered into each data cell representing whether or not that actor nominates the other actor for participation in the project. I had this data for each of the projects studied in both towns.

The first way to structure the data is as two-mode binary data, with actors as the X-axis variable and projects to which they belong as the Y-axis variable. To do this, I had to produce participation rosters for each project. Actors who acknowledged themselves' as part of the project were added to the roster if another actor also nominated them as participants in that project. Once the rosters were complete, chars were set up for each community with on the X-axis and projects on the Y-axis. A "1" was entered in the data cell where actors were participants of projects.

A second way to structure the data as two mode data is with nominating actors as the X-axis variables and nominated actors as the Y-axis variables. In the cells is entered a weighted value, the number of projects the nominating actor claimed to share with the nominated actor, though each actor may only nominate themselves for up to three projects. This will indicate the frequency of contact between the two actors. This data is two-mode data, but because it has the same variable labels along the X-axis and Y-axis it may be accidentally treated as one-mode data in UCINET.

Third, one-mode data can be structured with the variables for both axes as actors. The data can be either binary or weighted. For binary data, if the actors share participation on any project a "1" is entered in the data cell. If they do not share a project a "0" is entered in the data cell. To have a weighted value, enter the number of projects they share in the data cell. The problem in this case is that the actors were limited to nominating themselves for three projects, so the value will be between 0 and 3.

Fourth, and finally, one-mode data can be structured with projects as the variables for both axes. The data can be either binary or weighted. For binary data, if the groups share

any actors a "1" is entered in the data cell. If they do not share actors a "0" is entered in the data cell. To have a weighted value, enter the number of actors they share in the data cell. The un-weighted table reveals the structure of overlap among the groups. The weighted table reveals the strength of overlap between the groups.

I used two-mode binary data, the first option, because it is necessary for lattice visualizations. The other data structures allow for other sorts of visualizations. In some, actors are groups and in others actors are individuals. Relationships are shared participation between actors or shared actors between groups.

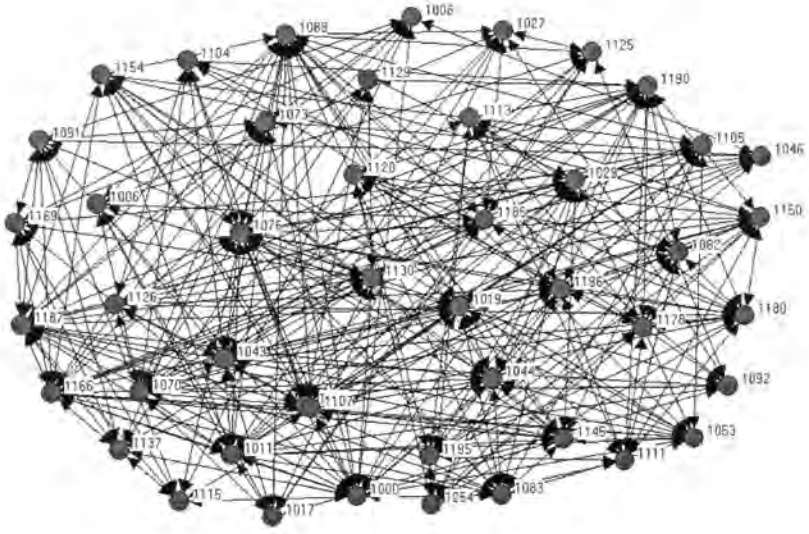
Network Visualization

The most common visualization methods are presented using a single set of data, to show how different visualization techniques show different aspects of the same set of relationships. The data in Table 3.2 (in appendix) is one-mode binary data describing the relationships among individual actors in Hillside. The table for Meadville was omitted. These Figures tend to reveal strong clusters because the data is structured according to formal group participation. Figures 3.1 through 3.5 were created using UCINET.

Figure 3.1 illustrates the data in Table 3.2 (in appendix) from Meadville as well as illustrating Table 3.3 (in appendix) from Hillside. The points are actors. The lines connecting the points are the actor's contacts with one another through projects. The visualization is unstructured and generally uninformative. There is no theory of visualization do give the system form.

Figure 3.1 - One-Mode Binary Random

Hillside



Meadville

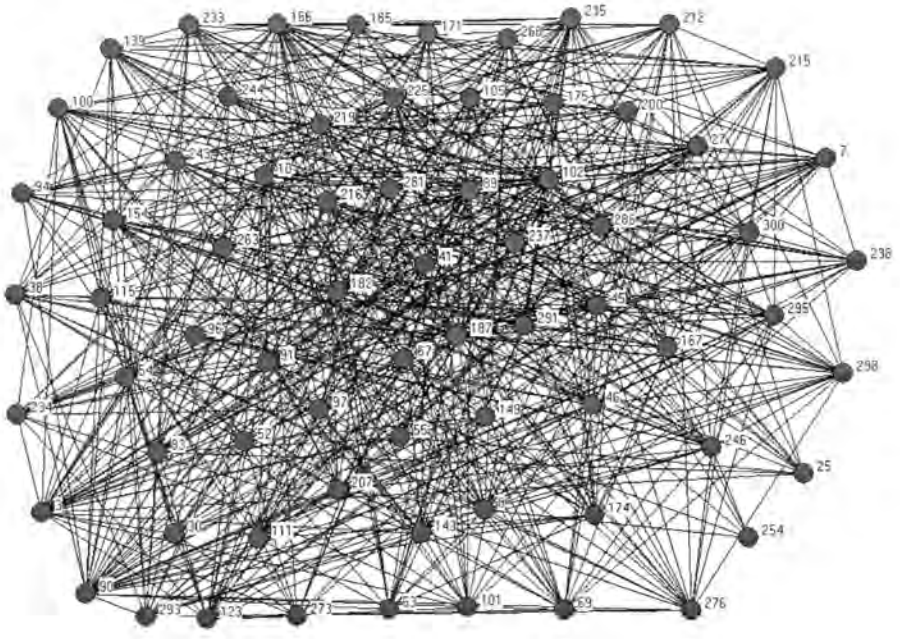
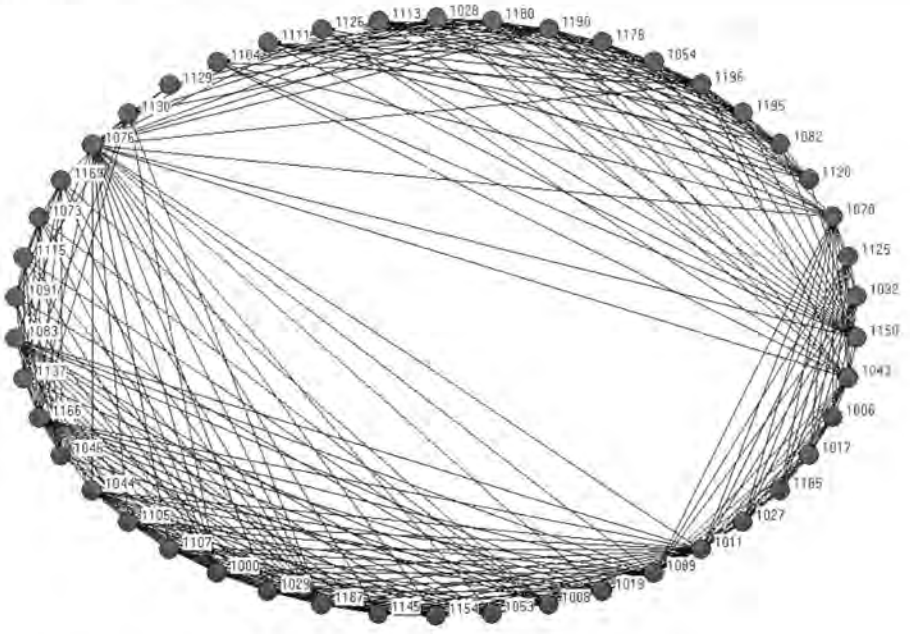
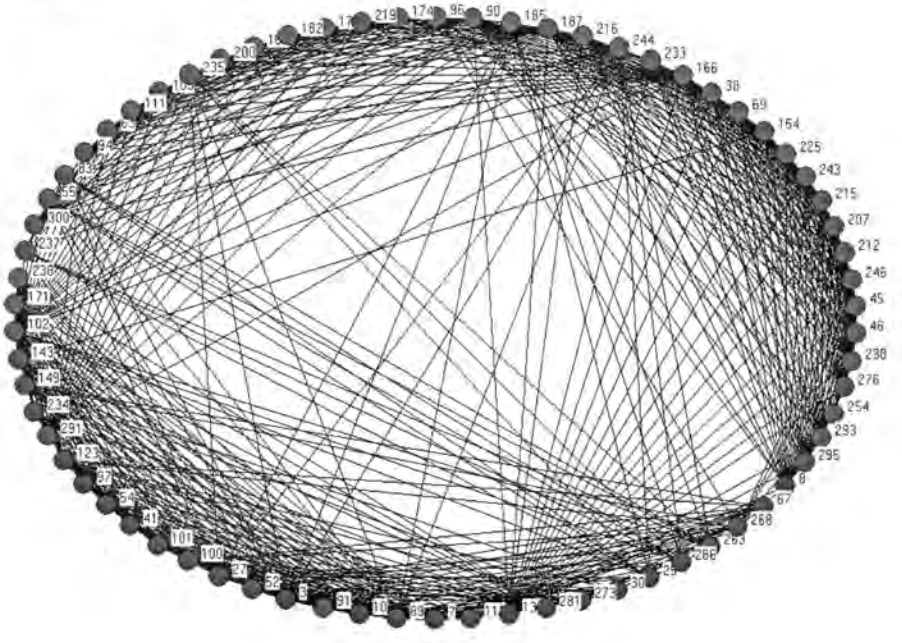


Figure 3.2 - One-Mode Binary Circle
Hillside



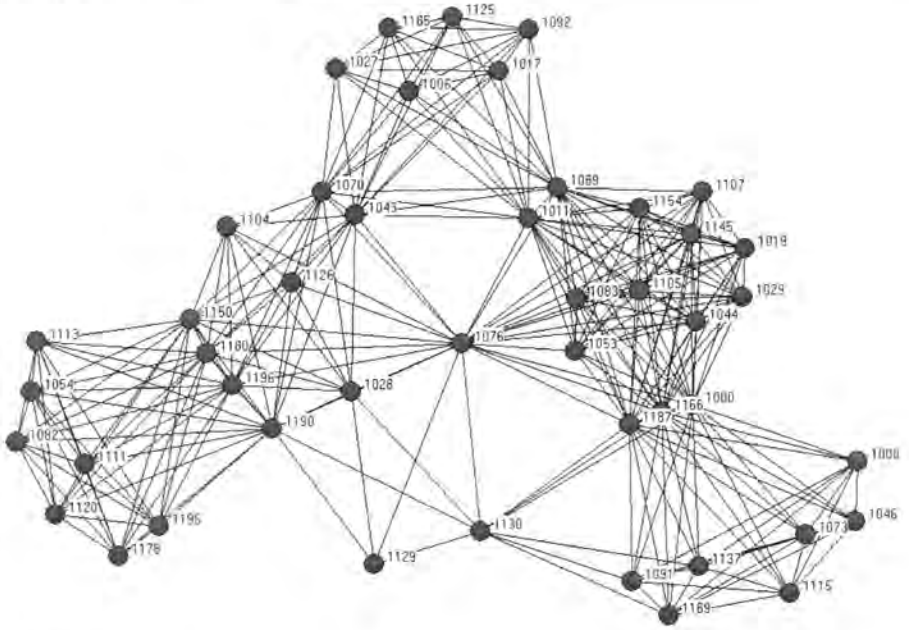
Meadville



One of the simplest theories of visualization is to arrange the actors in a circle, putting the connected actors near to one another. General clustering emerges and it is possible to see the emergence of unstructured groups. This technique can be useful with data containing no group structure. If the data are gathered simply from contact and interaction without purposive groupings, this technique can reveal the formation of unstructured groups. In Hillside in Figure 3.2 (still drawn with Tables 3.2 and 3.3) there is a cluster emerging in the bottom left and another along the top. A third is on the right. Key individuals can be seen as those who have more dense webbing about them. This technique is most useful for exploratory research with a group where nothing is known about the structure.

With algorithms from UCINET, the actors can be rearranged into clusters of actors like figure 3.3 (still drawn with Tables 3.2 and 3.3). Actors in dense clusters become a group. Actors bridging groups begin to be apparent. It is then possible to measure characteristics of the group such as *density* (the number of links among a group of actors over the total possible number of links), or characteristics of the positions within the group such as *betweenness* (the number of times a given position falls between two other positions) and generalize by considering the attributes of the actors and the network. There are many measures and established theoretical relationships to social capital (Borgatti, Jones and Everett, 1998).

Figure 3.3 - One-Mode Binary Clustered Hillside



Meadville

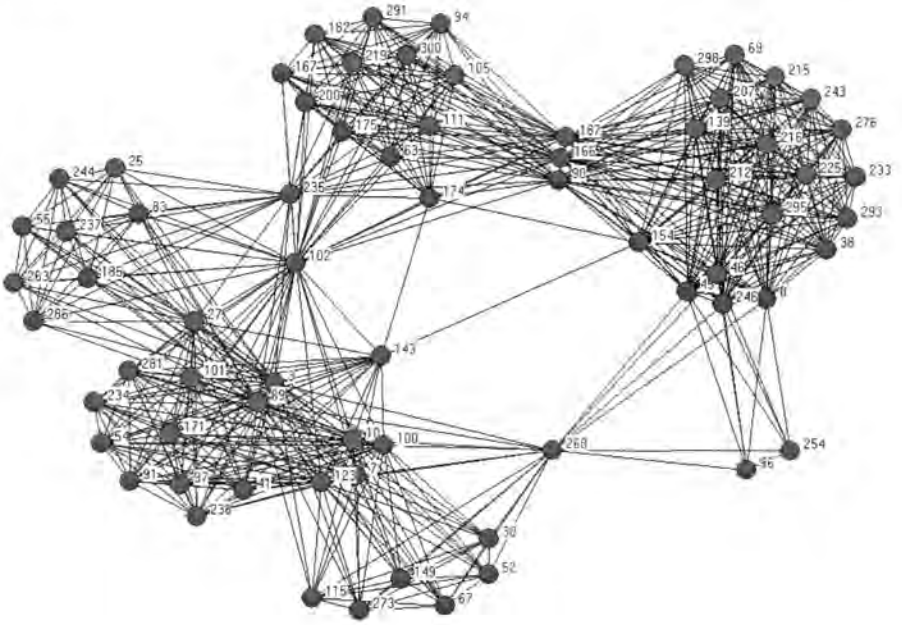
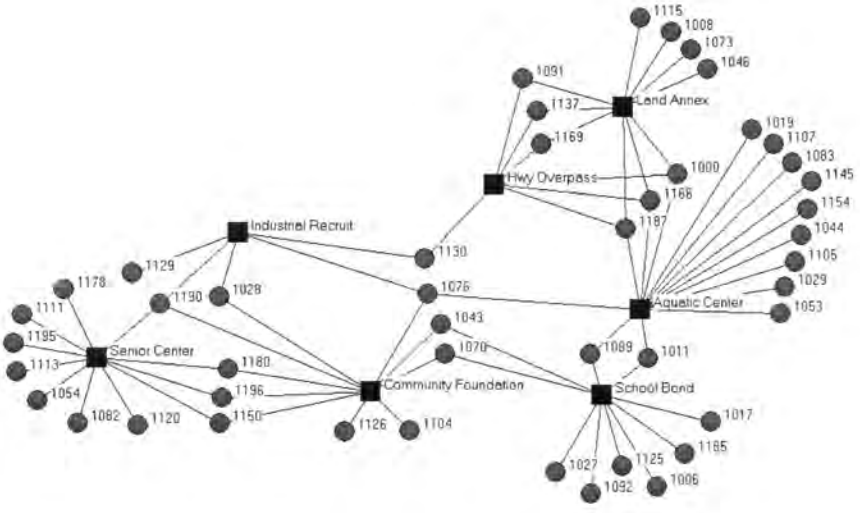


Figure 3.4 - Two-Mode Binary

Hillside



Meadville

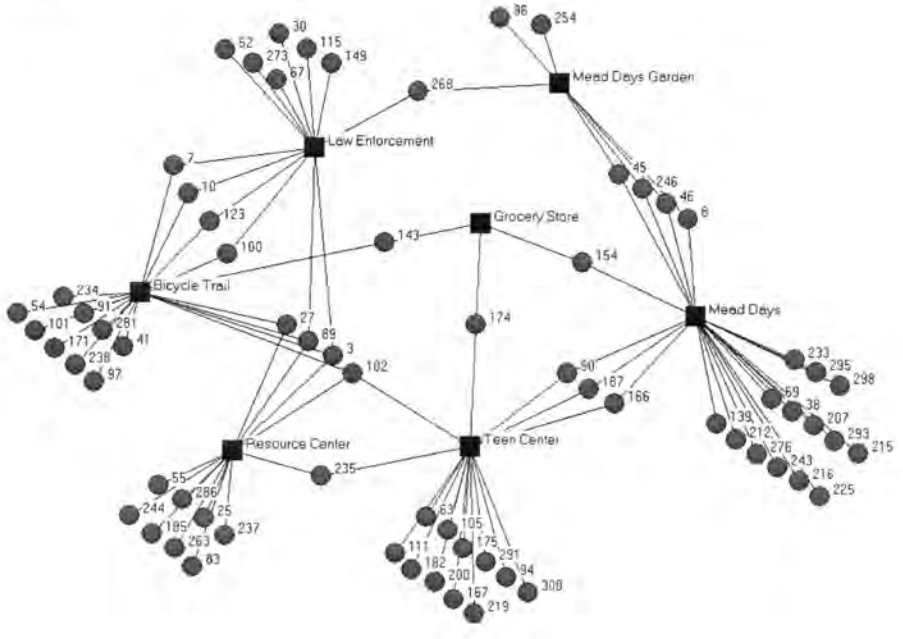
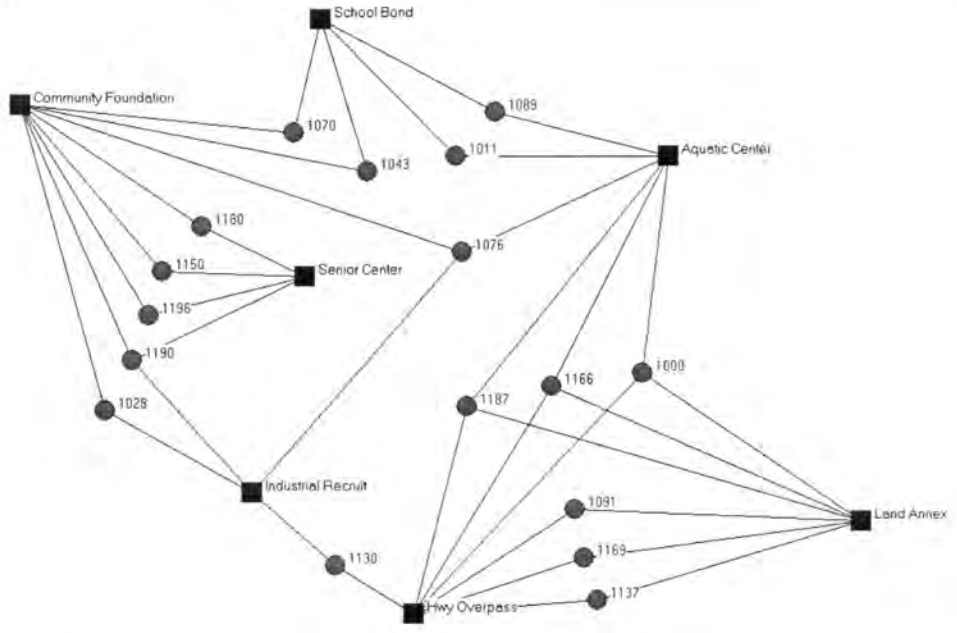


Figure 3.5 - Two-Mode Binary Simplified

Hillside



Meadville

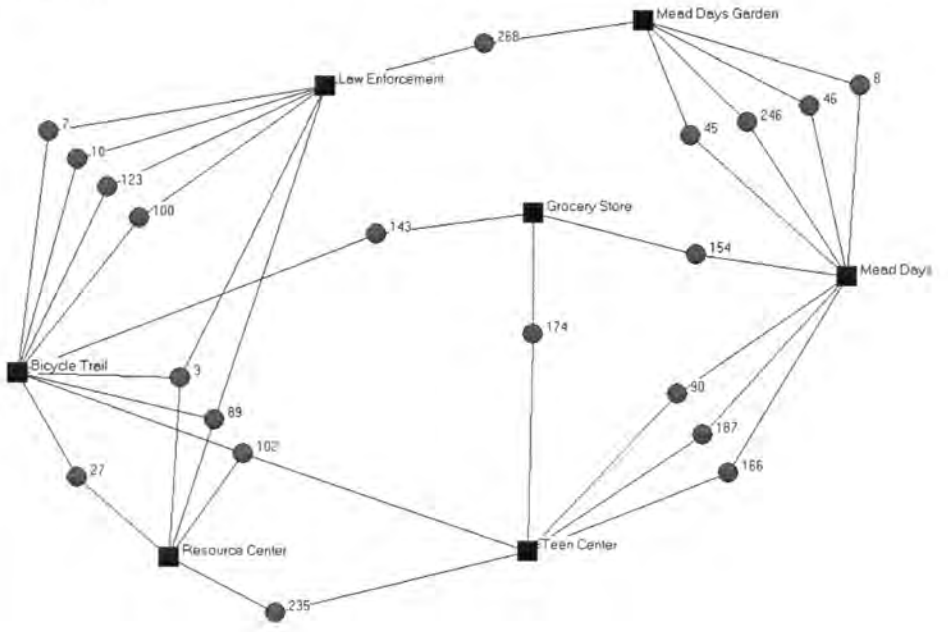
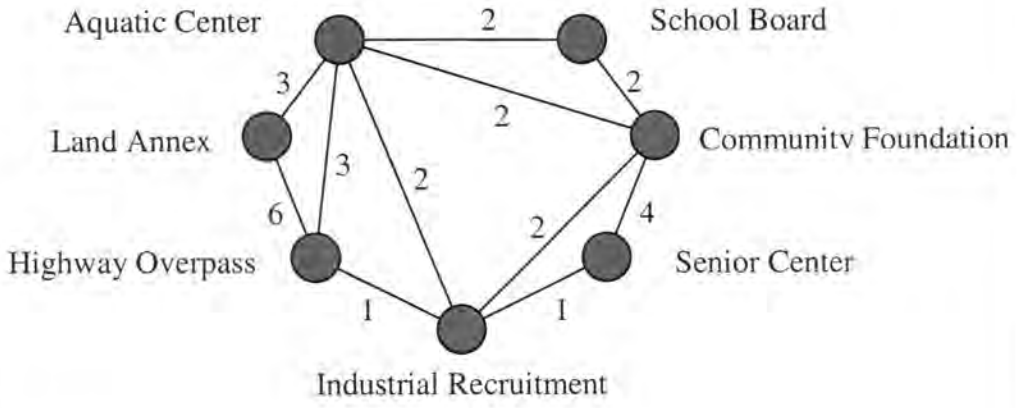
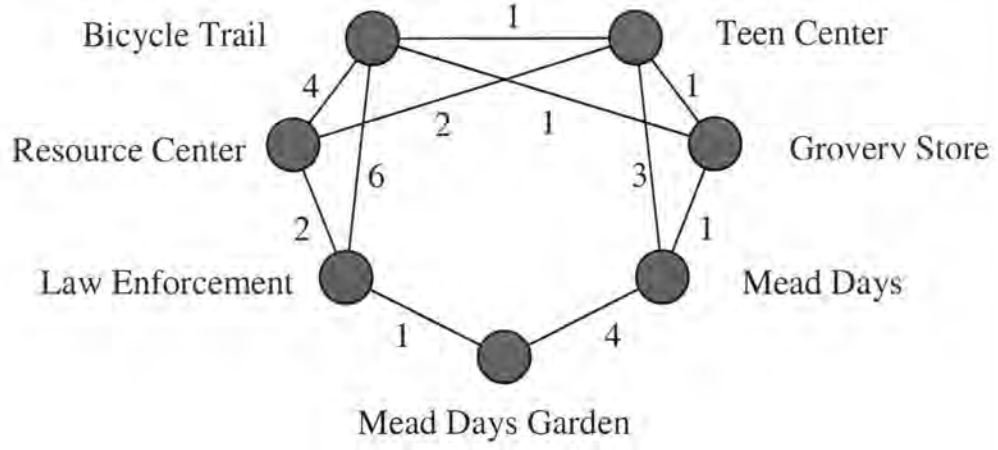


Figure 3.6 – One-Mode Weighted Groups
Hillside



Meadville



Using two-mode data, even more information about these actors is revealed. The tables (in the Appendix, Table 3.4 is Hillside and Table 3.5 is Meadville) are structured according to the first (1) example in the *structuring network data* section. The X-axis variable is actors and the Y-axis variable is the groups to which they belong. The Table contains data from Hillside, but both communities are rendered in the Figures 3.4 and 3.5.

Figure 3.4 shows actors as circles and projects as squares. Individuals bridging projects are unambiguously identifiable in visualizations of two mode data. Actors serving no structural purpose other than increasing the population of projects also become evident. In Figure 3.5, those individuals are dropped. Only groups and their connecting individuals remain. The actors with the most important bridging roles are evident, as are centrally located groups. In Meadville, note the position off the grocery store.

Figure 3.6, drawn using Tables 3.6 (Hillside) and 3.7 (Meadville) in the appendix, shows the projects as circles and the count of the actors connecting them along the lines. The data is structured as described in example four (4) in the *structuring network data* section. The data are weighted, as opposed to binary.

"Multiple density" is a measure used by Sharp, Flora and Killacky (2003) for describing a meso-level group characteristic. Any set of linked projects has a "multiple density". It is determined by dividing the number of shared participants across each link by the number of possible links. In dyads, there is one possible link so the number on each link is the "multiple density" for that link. A triad has three links possible, so a triad's "multiple density" is the sum of the actors shared by each pair of projects divided by three, even if there are only two links present. The "multiple density" of Hillside is the sum of the dyadic multiple densities divided by the potential number of connections among the projects. There are 28 actors overlapping participation in multiple groups and there are 21 possible connections, so the "multiple density" for Hillside is 1.33.

Simple density is the number of connections, each counted only once even if multiple connections occur (11 this time), divided by the number of potential connections (28 again) making the simple density .39. When making comparisons among groups containing similar demographics, density measures are related positively to social capital. (Borgatti and Jones 1998)

Traditional models of visualizing networks show clusters of dense subgroups linked to other dense subgroups by bridging ties. Those models are useful for macro application because the likelihood off macro structures' constituent parts co-existing in multiple macro units simultaneously is low. At the micro level there needs to be a way to express all of these things at once; the aspects and assets of the individual, the variant natures and extents of their ties to other individual actors, and the way people exist in more than one group at the same time.

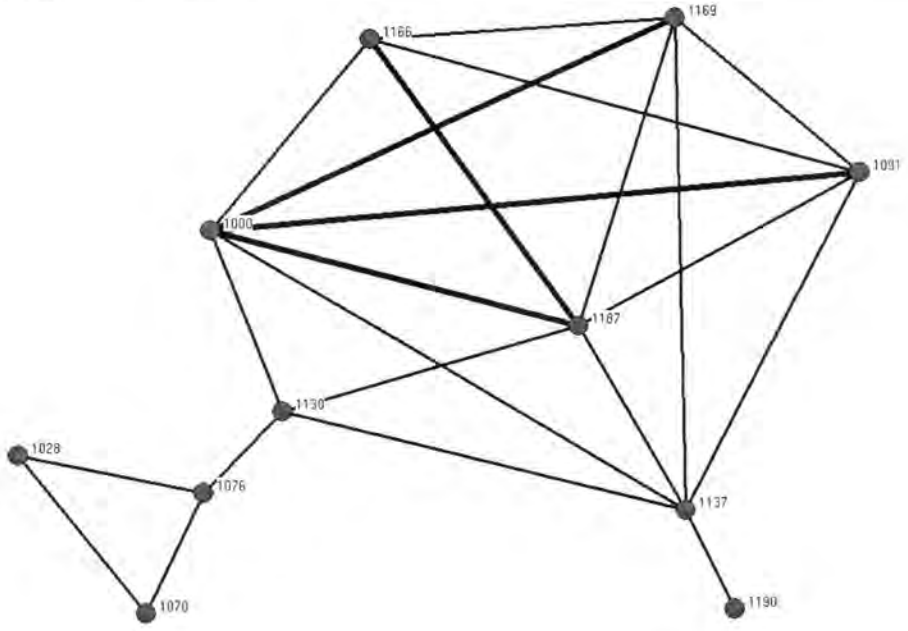
Past Findings with the Data

Agnitsch (2003) showed that network data can be used to measure social capital as it shows social relations and structural features that are relevant to the outcome of interest, in this case community development.

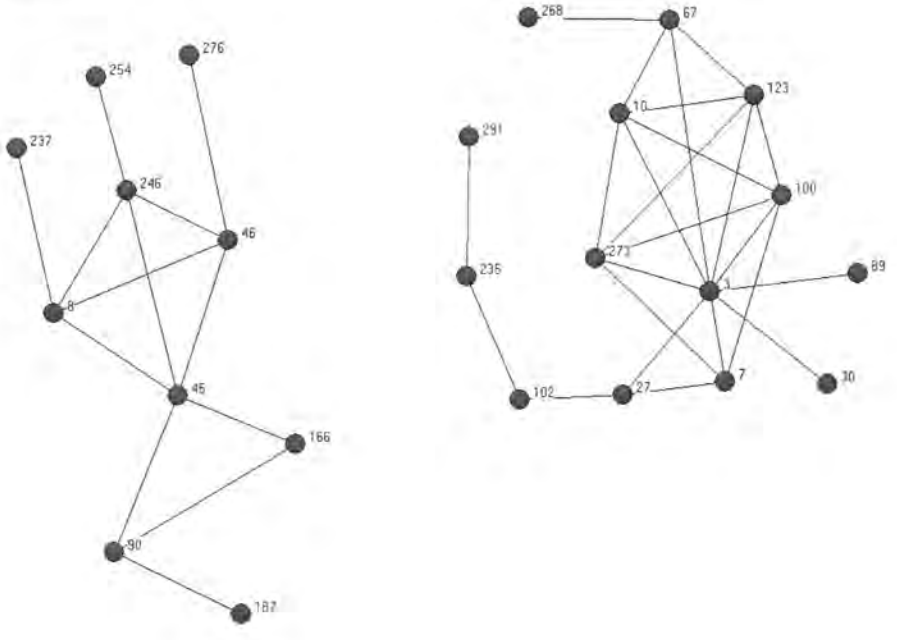
In gathering the data used in this thesis, she asked each actor to name up to three community projects they were involved in. She then asked them to name any other actors from the town who were also involved in the projects. This offers a particularly high degree of internal validity because self-nominations for involvement in a project can be corroborated by nomination from other community participants. Laid out in a single modal table (table 3.8 for Hillside and table 3.9 for Meadville in appendix) the strength of each relationship is weighted as the number of times a person nominates another person as being involved in a project with that person, so that relationship will range from 0 to 3, as described in the third (3) example in the *structuring network data* section.

Figure 3.7 - Core Structures

Hillside



Meadville



Agnitsch's treatment of the data results in a visualization like figure 3.7. I eliminated all relationships with strengths of one. Agnitsch restricted the population using regime theory, where a core structure is identified using measures of centrality. The result is similar enough for illustrative purposes. The visualization only shows the more connected community participants and the strength of the connections is expressed by the thickness of the lines. Hillside is made up of higher weighted connections, more densely related. Meadville is made up of two separate cores.

Agnitsch (2003) showed that relational data can be effectively examined using network models. Her analysis revealed many characteristics of the communities' structures of bonding social capital, and the bridges among in-community elements. Agnitsch found that bridging social capital must be specified in theory to be measured using network analysis.

Rather than regime theory, I examine community social capital as participation in groups, which are part of the community field. The relational structure of the entire community will reveal a hierarchy, as participation in multiple projects equates to higher amounts of community social capital. Applying the participation data to the Galois lattice structure will reveal a hierarchy of community social capital, ascribing value to each participant in those groups, according to where they fall on the lattice. Higher lattice position is equivalent to having higher community social capital, as defined by Putnam (1993, 2000) and further illustrated by Lin (2001).

Lattices

Linton C. Freeman, who originally conceived of measuring the density and centrality of a network, proposed the Galois lattice as the way of quantitatively visualizing networks to resemble the observations of ethnographers.

Galois lattices express two-mode data, by expressing each actor's group participation. Actors are on the top of the lattice and projects are on the bottom. The lattice reveals where groups form along lines of multiple participation and illuminates informal structures. Most interesting is that it reveals a coordinating, formal or informal, structure above purposive interest groups. It reveals the existence of a community field.

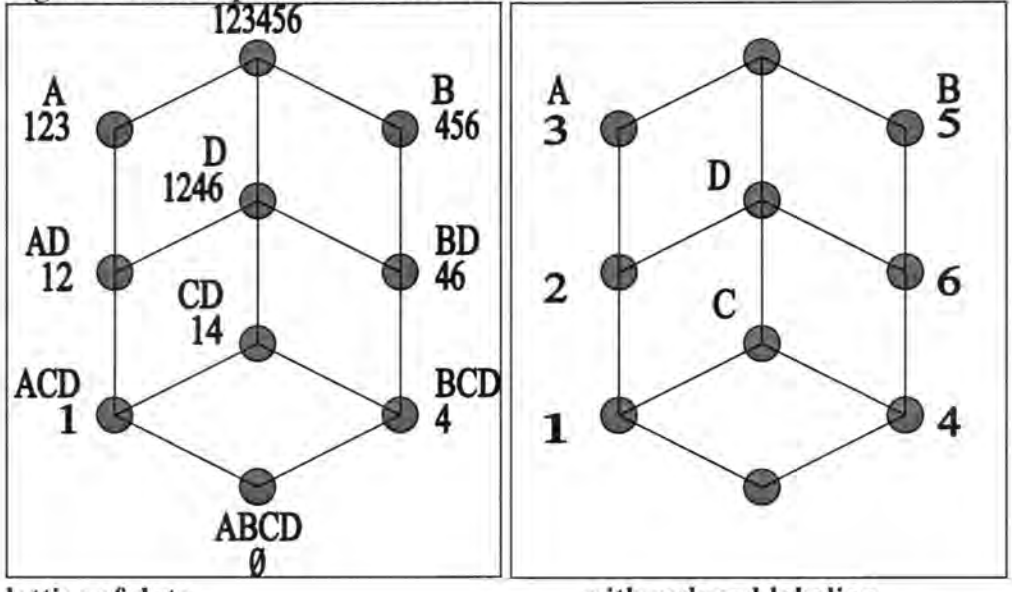
If all of the groups in the lattice are community interest groups, the groups (formal or informal) in the upper area of the lattice can coordinate the elements below them. The upper part of the lattice is the community field. The characteristics of the community field can be measured for a structure that is theorized to be effectively organized; representative and well connected. If there is no connection among the actors in the community field, then it has no ability to serve its coordinating function. By measuring aspects of the community field relative to its whole, we can evaluate its potential and make recommendations for further development, such as identifying disconnected groups and suggesting key actors for recruitment or education efforts.

The Galois lattice has the inherent advantage of constructing a hierarchy from any table of data where the variable of the X-axis is actors and the variable of the Y-axis is groups to which they belong and group participation is theorized to be significant, as it is in community social capital. Galois lattices use set theory math, where one mode is a set, a collection of actors. The other mode is another set, a collection of assets, in this case group participation. Using two-mode data, the first modal variable is in a complete set of actors at the top (the meet) while the second modal variable is in a complete set of groups at the bottom (the join) of the lattice. They both progress through the lattice in sets constructed of multiple shared participants. Places where groups overlap are the higher locations on the lattice. Higher locations on the lattice have participants with multiple group associations, connecting the lower groups.

Table 3.10 – Data for Sample Galois Lattices

ACTOR	EVENT A	B	C	D
1	1	0	1	1
2	1	0	0	1
3	1	0	0	0
4	0	1	1	1
5	0	1	0	0
6	0	1	0	1

Figure 3.8 - Sample Galois Lattices



lattice of data **with reduced labeling**

In the data in Table 3.10, intersections where an actor is a group participants are indicated by 1's. If an actor is not a participant in a group, a 0 is entered. Figure 3.8 is a lattice constructed using the data in Table 3.10.

On the left of Figure 3.8 is the full labeling for purposes of illustration, on the right is reduced labeling. In large lattices it is impossible to fit the full labeling. At the bottom left of the lattice only actor "1" is a participant of groups "A","C" and "D". On the right, actor "4" is in groups "B","C" and "D", then immediately above, actors "1" and "4" are both in

groups "C" and "D". On the right of the lattice, moving down from the top, actors "4" and "6" connect groups "B" and "D".

This basic structuring allows the concise mapping of participation and its overlapping structure in any number of groups and with any number of actors, and it inherently reveals the structure of a hierarchy of participation and of a field structure.

Applying Galois Structure to the Data

It is the nature of Galois structures that any table of data where the variable of the X-axis is actors and the variable of the Y-axis is groups to which they belong and group participation is theorized to be significant, as it is in community social capital, a hierarchy of group participation results.

Participation in multiple community development projects indicates higher community development social capital. The participation data has been used in the construction of the Galois lattices seen in Figure 3.9. Remember that Hillside, on the top, was originally determined to have low bonding capital and Meadville, on the bottom was determined to have high bonding capital.

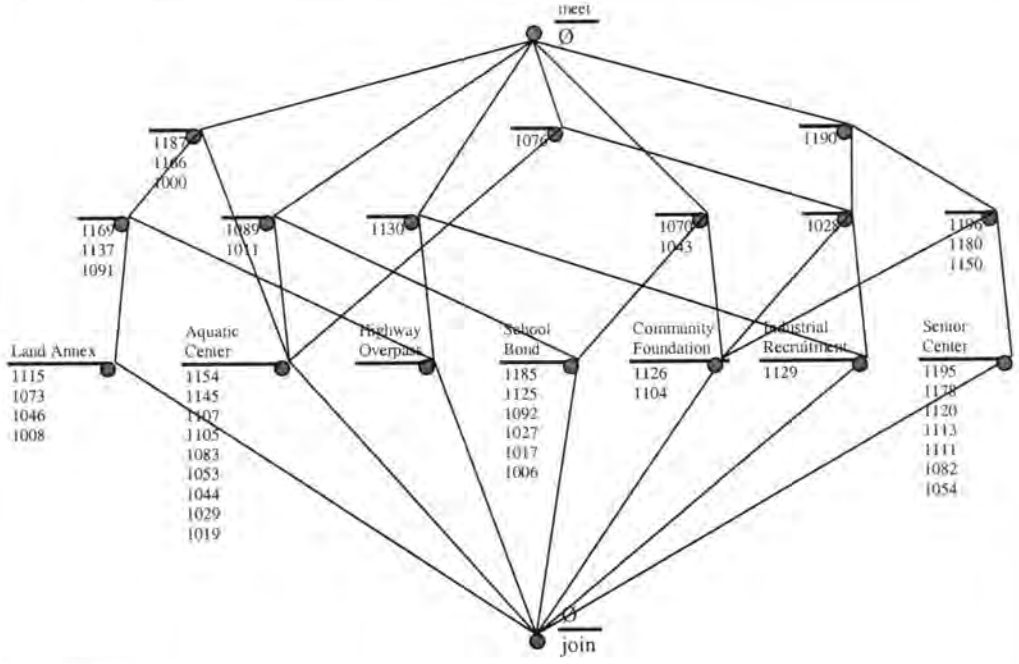
Both are small towns in Iowa. Both have somewhat limited populations. This is advantageous, as it simplifies the picture, and disadvantageous, as all the groups are on the same level. No single named organization draws its participants entirely from the other groups. If one such group existed it would be a bridging group and entirely within the community field. There are several informal groups that bridge the populations of two or more community development groups. Further research could be conducted to reveal whether those informal groups ever assemble. It may be that their informal nature is advantageous or it may be that formalizing them would be advantageous to the goals of community development.

In Figure 3.9 are lattices of the community development membership of both locations. The names of each group are listed above the line and the association is listed below. The locations of each group are found at the dot. In Hillside there are seven community organizations, each located along the base level, and containing all of the participants of the groups to which it is connected above. On the second tier of Hillside are six groups of one to three participants each which all bridge two groups each, then at the third tier are two actors, groups with one participant, who bridge three of the base groups each and a set of three participants on the left who collectively bridge three groups.

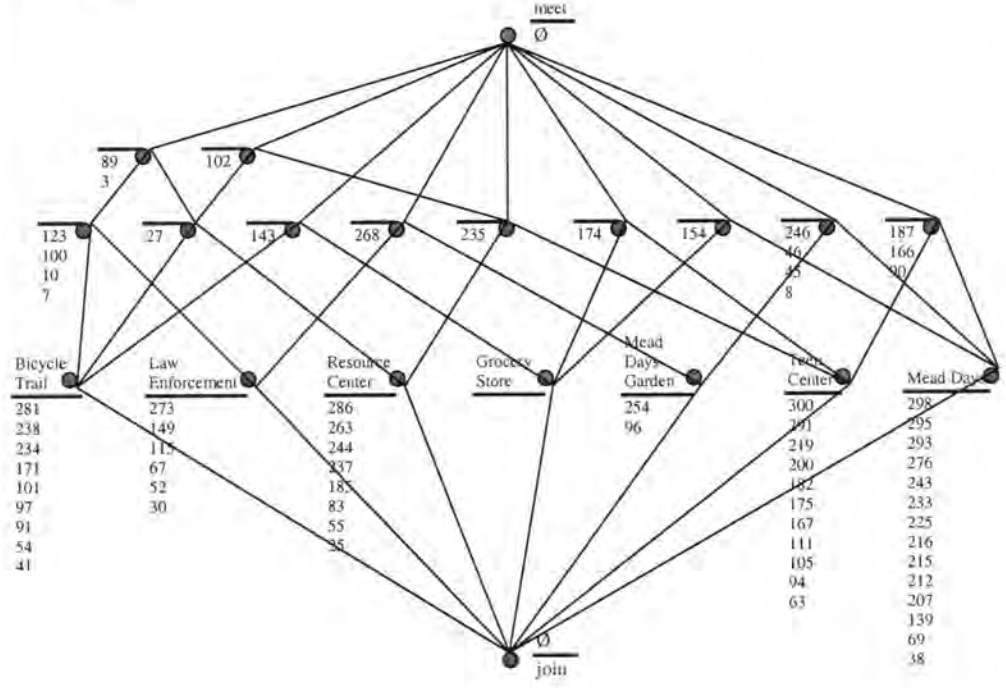
In Meadville, there are also seven groups along the bottom that have been identified as contributing to community social capital, then 9 groups that bridge two groups each, but four of them have only one participant. On the third tier are two groups. The first group has two participants and the second group has one participant. The actors in each group share participation in the same organizations.

The actors at the top of the lattices have more community social capital, using participation in voluntary community organizations as a measure, because they are inherently those actors with the most participation. The data have been structured in such a way that group participation has revealed the informal structures of the community development sectors of Hillside and Meadville. This structure makes it possible to identify the community field and to analyze the community development sectors for the presence of various forms of social capital, returning the thesis to the hypotheses from chapter one.

Figure 3.9 - Galois Lattices
Hillside



Meadville



IV. DATA ANALYSIS

Member Lattices

This thesis uses a network visualization technique for data analysis that diverges from any of those presented in chapter 3. The visualizations used in this chapter, member lattices, emerge from the Galois lattice but in a simplified graphic. The member lattice focuses on groups' structural locations with the community and community field. The data is structured by emergent groups. From the Galois lattice, the total number of members in each group is represented along with the levels of hierarchy and the connections among the groups. All connections across lines of hierarchy are inherently vertical and all members of a group are inherently horizontally connected to one another. Actors on levels above the first level are more connected, both horizontally and vertically, than actors on level one.

Groups at each level of hierarchy connect to the same number of projects below themselves. Group participation is the operationalization of social capital. If any actors had been members in more than three projects then there would be another level to the hierarchy. Actors were not able to be members in more than three projects due to how the data were gathered.

Member lattices show a natural clustering that matches hierarchical Euclidian structural equivalence matrices from the same data. Structural-equivalence matrices reveal the relationships between any two actors. The hierarchy that results from those matrices exactly matches the structure of the Galois lattice, though the lattice is much easier to understand visually and is more revealing of the informal structure of the population. For comparison purposes, I have included the Euclidian structural equivalency matrices for Meadville (Table 4.1) and Hillside (Table 4.1) in the appendix. The superiority of lattices is immediately evident.

In member lattices individual identities are not shown. All values are relative to the local populations or the total number of possible occurrences of a given situation within the population. All values fall between zero and one.

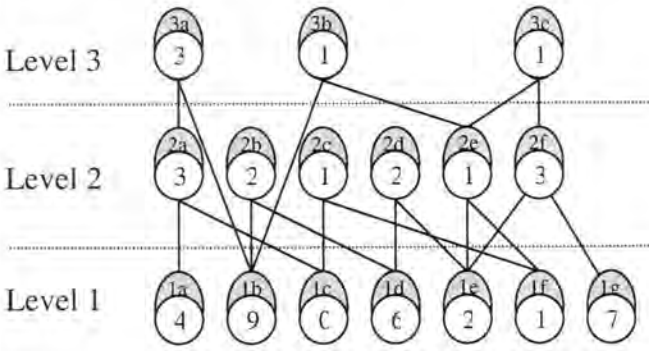
The lattices in Figures 4.1 and 4.2 are the foundations of all subsequent lattices. Those figures express the level of participation in formal and informal group. The hierarchical level of each group and the connections among them are shown. The numbers above each group (ie 1a, 1b, 2a, 3a) are labels, for reference. The number in the label is the level of hierarchy where the group will be found. The letter is the position of the group form left to right.

When considering the "unique-members lattice", Figure 4.1, the numbers do not represent the presence of actors occurring at higher levels of hierarchy. Each number is only the quantity of actors unique to that location. The sum of the groups at all of the levels is the total population.

In the "total-members lattice", Figure 4.2, the membership of each group includes participants from higher level groups that are connected, and so the number represents the total population of actors present when the acknowledged participants assemble. The result is that the sum of the populations of level one group's is larger than the total population, so long as there is at least one level two group.

Figure 4.1 - Unique Group Membership Lattice

Hillside



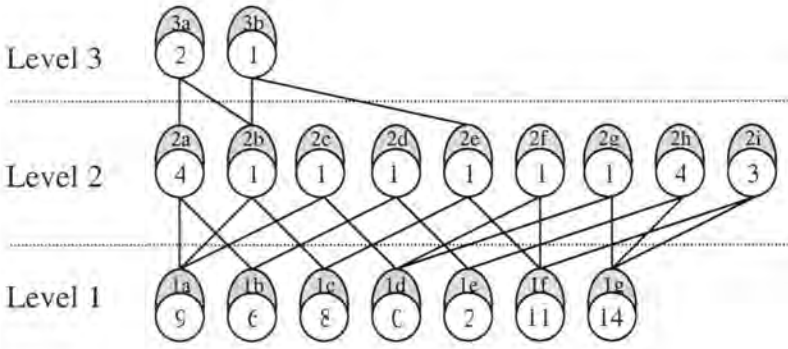
0 upward ties
3 groups
5 actors

4 upward ties
6 groups
12 actors

14 upward ties
7 groups
29 actors

18 total ties
16 total groups
46 total actors

Meadville



0 upward ties
2 groups
3 actors

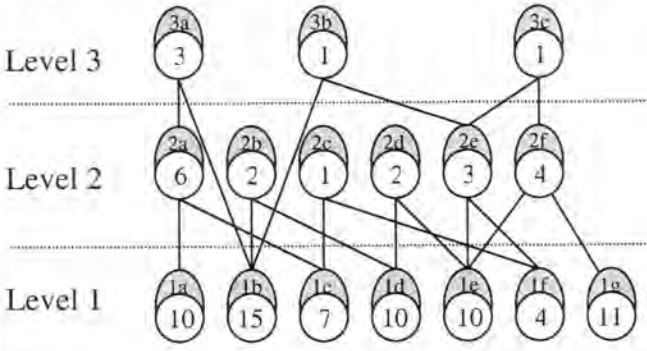
4 upward ties
9 groups
17 actors

18 upward ties
7 groups
50 actors

22 total ties
18 total groups
70 total actors

Figure 4.2 - Total Group Membership Lattice

Hillside



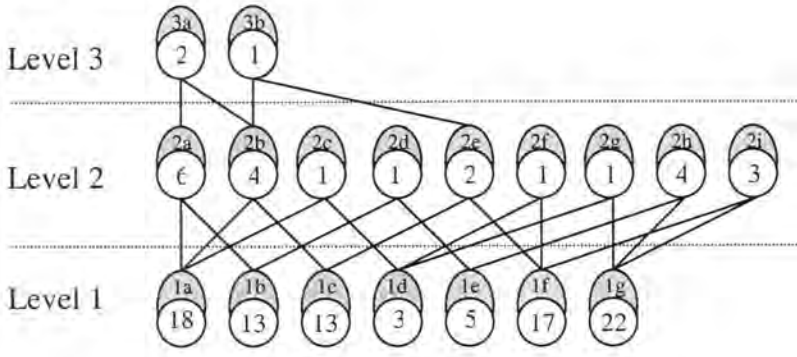
0 upward ties
3 groups
5 actors

4 upward ties
6 groups
18 actors

14 upward ties
7 groups
67 actors

18 total ties
16 total groups
90 total actors

Meadville



0 upward ties
2 groups
3 actors

4 upward ties
9 groups
23 actors

18 upward ties
7 groups
91 actors

22 total ties
18 total groups
117 total actors

Computing Member Lattice Values

The actor in a member lattice is a group. The actor-group's population, either unique or total, becomes a representation of the group. Relationships among the actors are also represented. Using the four member lattices in Figures 4.1 and 4.2, it is possible to determine bonding, bridging, horizontal and vertical social capital within the hierarchy, for each location.

An actor's *bonded ties* score measures the degree to which an actor is enmeshed in the community. An actor's *bridged ties* score measures the potential of that actor to bring together otherwise disconnected groups. All connections (lines) are inherently vertical, and each level is horizontal. An actor's *vertical* ties score measures the potential of that actor to connect groups from different hierarchical levels. An actor's *horizontal* ties score measures the portion of the community with which an actor is connected. All measures are considered to be intra-located to the community, so a bridge in this case is between groups in the community rather than leading out of the community, and a vertical tie is vertical to the hierarchy within the community and not reaching to groups from outside of the community.

Scores for the various sorts of ties are determined as follows. The name of the tie and a brief description of how to arrive at a score are described in Table 4.3. At the right of the table, scores are figured for four sample locations in Hillside. Discussions of the techniques for computing scores accompany Figures 4.3 through 4.6, which show the detailed values for each group.

It is possible to figure demographic data, by looking back to the Galios lattice and running traditional statistical models stratified by the location of the individuals on the unique group member lattice (Figure 4.1), though that was not done for this thesis.

Table 4.3 – Ties and their descriptions for Member Lattices

Name	Description	Sample math for Hillside groups			
		2a	3a	1a	3b
Bonded	Connected level 1 population/ total level 1 populations.	17/67=.25	32/67=.48	10/67=.15	36/67=.54
Bridged	Base connected groups/total base groups.	2/7=.29	3/7=.43	0/7=0	3/7=.43
Vertical	Connected groups off level/total groups off level.	3/10=.3	4/13=.31	2/9=.22	4/13=.31
Horizontal	Actual number of people in contact/ total population	11/46=.24	23/46=.5	10/46=.22	26/46=.57

Computing Social Capital Tie Values in Member Lattices

Bonded Ties

First, choose a grouping to be ascribed a value, i.e. 1a, 2a, 1b, etc. That group will be referred to as the "key group". *Bonded* ties are determined using the using the total group membership lattice (Figure 4.2). The numerator is determined by the total population of level-1 groups connected to the "key group." Trace ties from the key group to all connected groups in level-1. Sum those group's values.

As an example consider group "3a" in Hillside. It is connected to "2a" and "1b". "2a" is in turn connected to "1a" and "3a". The total population of level 1 groups connected to group "3a" is 32 (10, 15, and 7).

The denominator is the sum of the actors in the level one groups of the "total members lattice". In the case of Hillside, it is 67, in Meadville it is 91. For "3a" in Hillside the numerator is 32 and the denominator is 67, 32/67=.48.

Multiple occurrences of actors are figured into the numerator and denominator, therefore members with multiple points of contact are differently weighted. This allows for duplication of actors who are members of multiple groups throughout the population shows

the degree to which an actor is enmeshed in the community. The number will be between zero and one, allowing the weighted scores to be compared.

Bridged Ties

Either Figure 4.1 or 4.2 may be used because a group's *bridged* ties value is determined by counts of connected group's rather than the populations of those groups. The numerator for bridged ties is determined by counting the number of groups which the key group serves to connect, from level-1. This is done by tracing from the key group to level-1, like it was done for bonded ties, and counting the level-1 groups to which the key group is connected. Group "3a" in Hillside is connected to three level one groups.

The denominator for bridged ties is determined by the total count of level-1 groups. It is listed on the right side of Figures 4.1 and 4.2. In Hillside the value is 7, so group "3a" has a value of 3/7=.43.

Bridged ties are measures applicable to the members within each cluster and indicate the degree to which each grouping serves as a connection among other groups within the community. All level one groups have a value of "0" because they do not connect any groups from level-1.

Vertical Ties

Either Figure 4.1 or 4.2 may be used because a group's *vertical* ties value is determined by counts of connected group's rather than the populations of those groups, as the bridged ties score does. The numerator for vertical ties is determined by counting the number of groups from other levels which are connected to the key group. This is done by tracing down from the key group along the ties, through all of the lower levels and counting those groups. Then trace up from the key group along the ties, through all of the higher levels and count those groups. The key group, "3a", in Hillside is connected to two groups

("2a" and "1b") directly, then through group "2a" to two more groups ("1a" and "1c") indirectly. The numerator for "3a" is 4.

The denominator for vertical ties is the total number of groups on levels other than the level of the key group. Those totals are listed by level on the right side of Figures 4.1 and 4.2. In Meadville, for group 3a on level 3, the value is 13, so group "3a" has a value of 4/13=.31.

An actor's *vertical* ties score measures the potential of that actor to connect and coordinate flows of communication and resources among actors from different hierarchical levels. Groups at different hierarchical levels have access to different resources, and so this coordination function is vital to the flow of resources through the community field to where they are most needed.

Horizontal Ties

The numerator for "horizontal ties" is determined by the total number of people with whom the group members are in contact. This is perhaps the most difficult number to determine. It is necessary to use the unique member lattice. From the "key group", trace the ties to level one groups. Note each of the groups on level one which are connected to the key group. Next, for each identified level one group, identify all upwardly connected groups. Sum the values of all identified groups to find the total number of people with whom the key group is in contact. Include the key group itself in all calculations.

As an example, consider Hillside's group "3a". Group "3a" is in direct contact with groups "2a" and "1b". Though group "2a", group "3a" contacts group "1a" and group "1c". Therefore, "3a" is connected to "1a", "1b" and "1c" on level one. Tracing back up from those groups, contact is made from the key group "3a" directly with "1a", "1b", "1c", "2a", "2b", "2c", "3a", and "3b". All of those actors share membership in a level one group with "3a". The sum of those group's members, from the unique member lattice, is 23.

The denominator for horizontal ties is the total population of all the groups. This is the sum of the actors in each tier, as listed along the right side of the unique members lattice. In the case of Hillside it is 46, and in Meadville it is 70.

Horizontal ties are measures applicable to the members within each cluster and indicate the portion of the population that they should know, because they are in contact.

Implications of the findings

This research demonstrates that there is a positive relationship between bonding community social capital, as indicated in prior work with this data (Aignitsch 2003), and all sorts of social capital indicative ties within a community field, as detailed in Figure 4.3 through Figure 4.6 using member lattices. For purposes of analysis, Figure 4.7 represents the data from figures 4.3 through 4.6 on a single page.

Community fields are effective coordinating bodies when they draw together representatives from as many groups into as concise a place as possible. Drawing from the literature in chapter two, the community field, in its role as leader and coordinator of the community development organizations, will act in the best interest of the community at-large. It will provide a shared vision and direction for the community, built from the desires of the base groups as expressed through their representation in the community field. It will facilitate the movement of assets to where they are needed most, supporting the weaknesses of some groups with the strengths of others for the betterment of the community as a whole. (Wilkinson, 1970, 1999) This is the theory around which the measures of bonding, bridging, vertical, and horizontal ties were designed.

The community field in member lattices focuses groups from one level by bringing together representatives from each group into groups at higher levels. At the top, ideally, is one group with connections (through other groups) to each of the groups at level-1. There is value in distributing coordination across smaller groups, because it reduces the possibility

that a group of elite can take control of the community development sector and direct it toward their own interests. At least one of each member of the base interest groups is present in the second level in both Meadville and Hillside, so there is at least some coordination possible between all of the community interest groups in the community.

Figure 4.8 shows the average scores and standard deviations for each bridge type at each level in the community fields in both towns, drawn from Figure 4.7. At the bottom of the figure is the average of the score for the field as a whole. Across the board Meadville scores higher than or equal to Hillside. In the averages section at the bottom, the score that represents the community fields as wholes, the scores are all higher for Meadville. This is entirely consistent with the four hypothesis proposed in chapter one.

Thus far, I have visually and empirically measured the elements of the community fields of two Iowa towns. To do this, I have used established techniques of network visualization like the structural equivalency matrices, and emerging elements of network visualization like Galois lattices. In making empirical measurements of social capital in the community field, sociological theory was applied to develop new methods. I find this superior to attempting to draw out sociological inferences from existing techniques. Now I will discuss the implications of this technique and some aspects of the theories that went into its development, lending to the validity of the measures taken being appropriate for a community field.

Figure 4.3 - Group Member Lattice, Bonded Ties

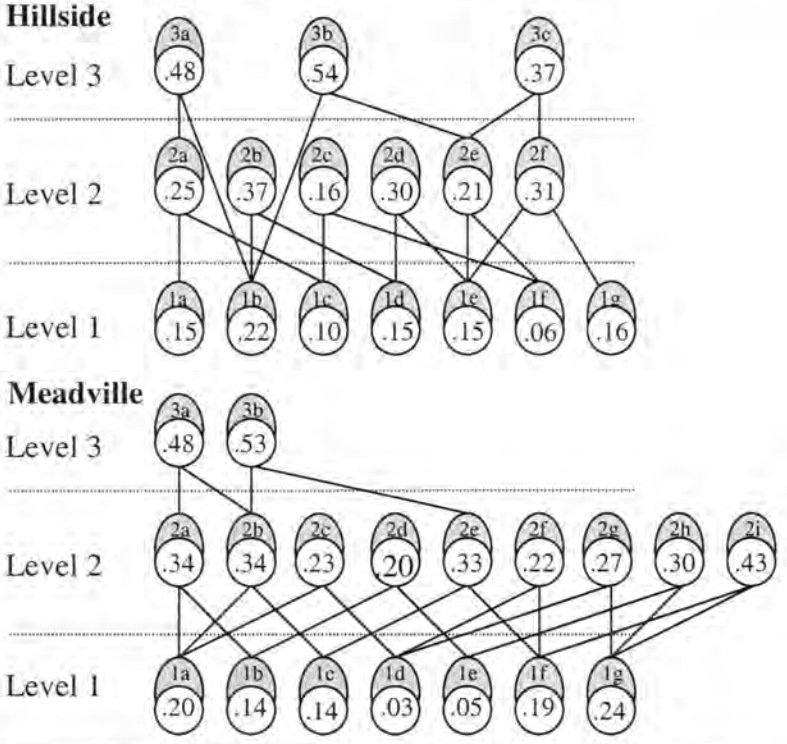


Figure 4.4 - Group Member Lattice, Bridged Ties

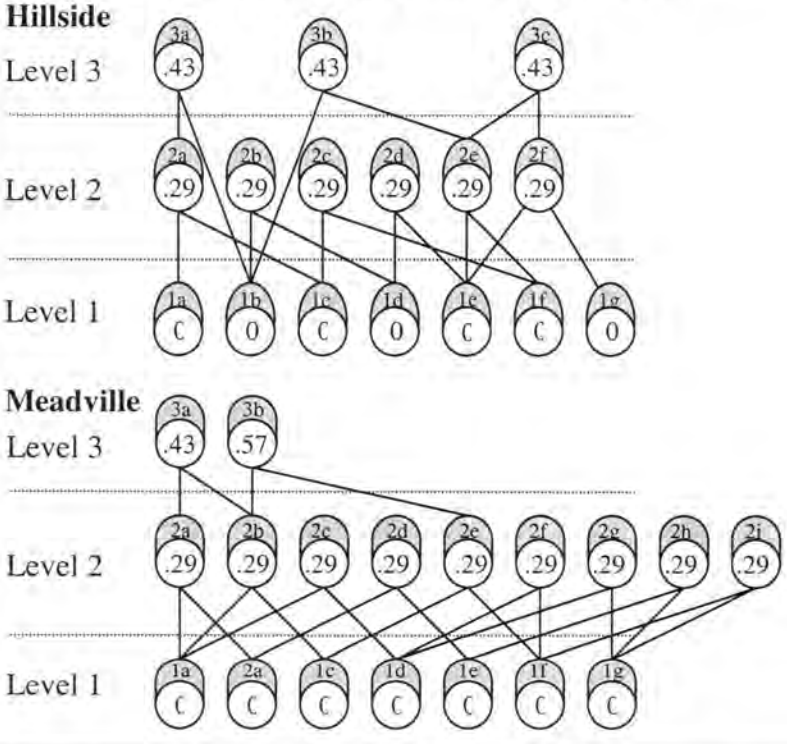


Figure 4.5 - Group Member Lattice, Vertical Ties

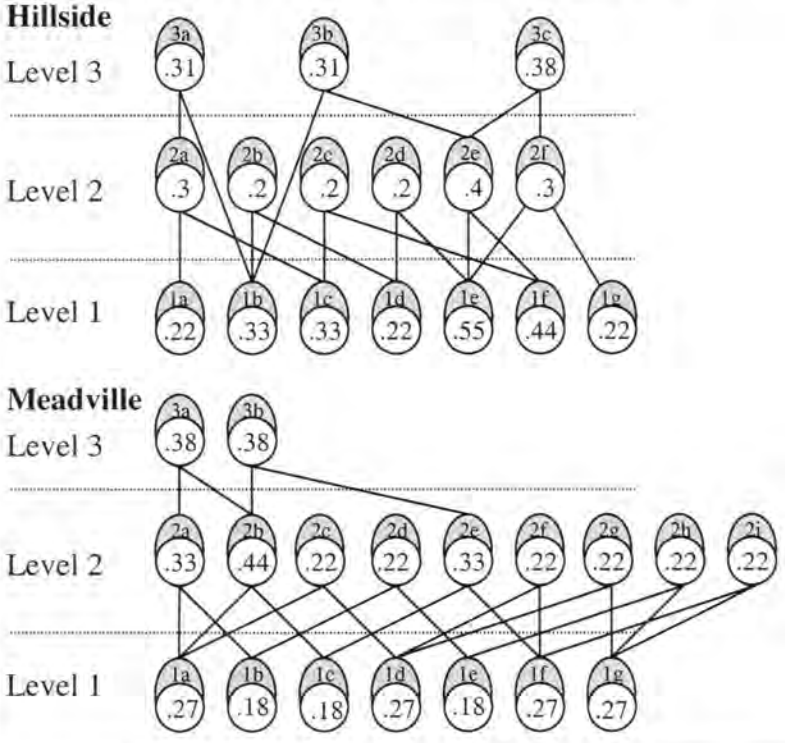


Figure 4.6 - Group Member Lattice, Horizontal Ties

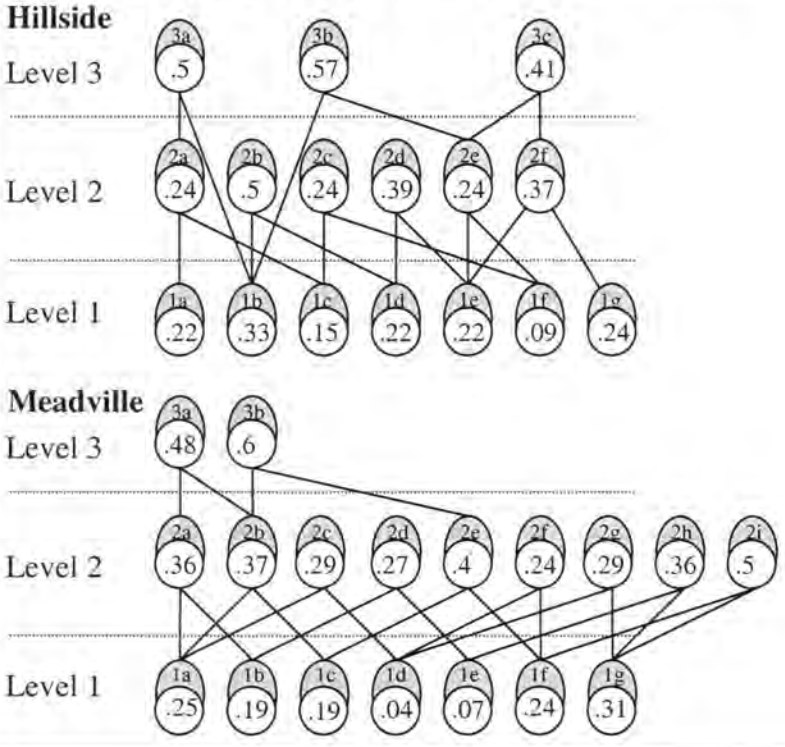


Figure 4.7 - Group Member Lattice, All Ties

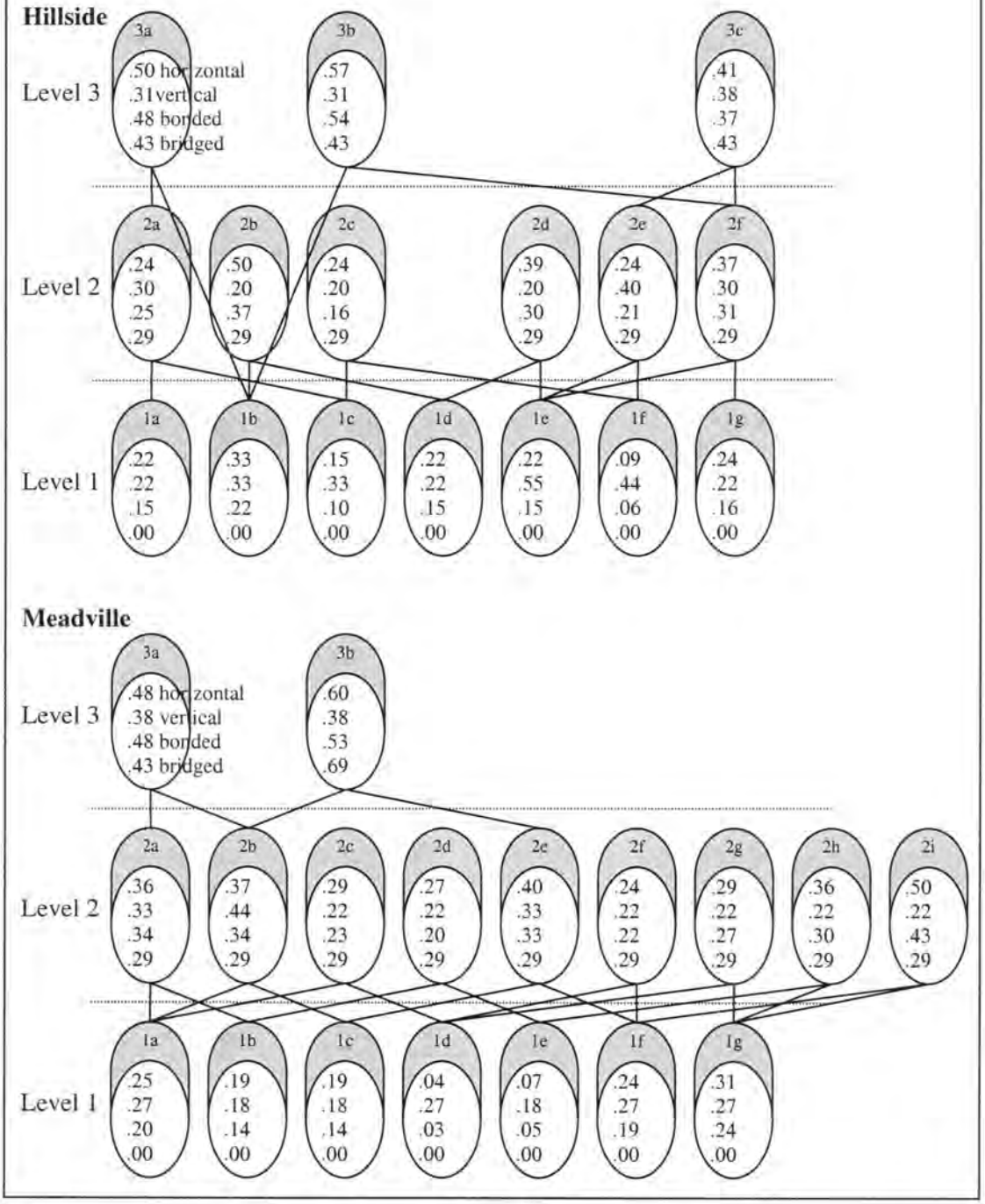


Figure 4.8 - Average Ties by Level in Community Field

Hillside

Level 3

	Average	Standard Deviation
horizontal	0.49	0.08
vertical	0.33	0.04
bonded	0.46	0.12
bridged	0.43	0.00

Level 2

	Average	Standard Deviation
horizontal	0.33	0.11
vertical	0.27	0.08
bonded	0.27	0.11
bridged	0.29	0.00

Average

	Average	Standard Deviation
horizontal	0.41	0.09
vertical	0.30	0.06
bonded	0.37	0.08
bridged	0.36	0.00

Meadville

Level 3

	Average	Standard Deviation
horizontal	0.54	0.08
vertical	0.38	0.00
bonded	0.51	0.24
bridged	0.56	0.18

Level 2

	Average	Standard Deviation
horizontal	0.34	0.08
vertical	0.27	0.08
bonded	0.30	0.08
bridged	0.29	0.00

Average

	Average	Standard Deviation
horizontal	0.44	0.08
vertical	0.32	0.04
bonded	0.40	0.05
bridged	0.43	0.09

V. SUMMARY AND DISCUSSION

The community field is a complicated structure, with properties implied by its nature that require further discussion. For a community field to function it must coordinate the efforts of the social fields present in the community. It must give them a common focus and allow for the completion of long term goals, that may be out of the grasp of any one organization. The community field is the place where the strengths and weaknesses of the elements of the community field are balances. If three groups have strengths which complement one another, but not in ways that allow any two to make direct exchanges, the community field allows the exchange to take place. It is the body that allows generalized reciprocity to work, and without it community development efforts will start and stop, b ut the community as a whole will be stifled and reduced. It is necessary to understand how to measure something so powerfully important, and the use of lattices is a starting place. I will now discuss why that is and where we may go next.

Homogeneity and Homophily

Simmel (1955) provided groundwork for Lin's use of homophily when he suggested that those with common interests tend to draw together. Homophily is the tendency for actors to interact with other actors like themselves, for reasons of positive sentiment. A closed group is one where all actors are in contact with all other actors and there is no interaction with non-group-members. A measure of how closely a group resembles that description is called closure. The inverse of closure is openness. Closure contributes to homophily and helps preserve those assets within a group. Openness is important in maintaining beneficial flows of network embedded assets (Coleman, 1990; Lin, 1999b; Granovetter, 1973; Burt, 1992). A group must be closed in respect to some assets and open

in respect to others depending on whether the group is trying to acquire more resources or to preserve existing resources.

Groups control resources by controlling flows of information. Within closed homogenous groups, altruistic motives incorporating mechanically bounded solidarity and values are sufficient for control. Outside of these conditions it is necessary to use rationality and enforceable trust for control. This is a fairly strong equation of the ideas of gemeinschaft and ties of closure, so ties of closure alone cannot explain rational interaction and do not necessarily follow the rules of rational interaction.

Homogeneity defines a group's boundaries. It is also possible to conform to multiple group identities and internalize their divergent goals. Groups with internal conflict, like the "log cabin republicans," can result. By cutting overtly across lines of homogeneity, organizations can, at least partially, realign a culture as members are forced to reconcile the conflict.

Bourdieu's Marxist conflict based model rewards actors for their ability to imitate the dominant culture. His vision of society suggests the need for revolution to realign hegemonic powers (Bourdieu 2000). In the end, for Bourdieu change requires class-based symbolic violence. For Coleman change results from systems of exchange.

Lines of homogeneity form the participation of groups of actors (one or more people). Groupings of related groups emerge. A hierarchy forms, where some groups serve a coordinating role within the larger group. For the purposes of this thesis, the larger group is the locality, or town, containing all of the community-focused organizations.

Relational Models

Simmel (1971, p. 69) calls society a "supra-singular structure." In doing so he lays the groundwork for defining networks as large series of interrelated groups. Those objects and relations contributing to the community field are the focus of study for community theorists, and others are set aside.

Actor's interactions construct social networks, so whatever the nature of social capital and what will ultimately be explained through measurement, we must begin with the idea that we are measuring actors *and* their interactions.

Traditionally, variable measures of assets were ascribed to isolate bodies. The interactions among them have traditionally been expressed as causal variable relationships. Using theory as a starting point to predict that something causes something else, variables are measured in an isolated way and a relationship is inferred from the association of the variables.

In a relational model actors and their relationships are observed. Both actors and their relationships are treated as independent variables, theoretically presupposed to explain a dependent variable. To measure the relationships among participants of a network, actors and their relationships are designated to serve as independent variables according to the theory being used. Common network measures include frequency and nature of contact, and acquisition of essential and universal needs (Portes, 1999a; Lin, 2001). The key distinction between traditional models and relational models is that in relational models, the distinct aspects of the system are assumed to be interrelated and dynamically emergent. The actors are changed by the relationships they hold and the relationships are formed by the actors, cyclically (Emirbayer, 1997).

Networks of Interaction

Emirbayer (1997) tells us that simply studying actors or relationships is insufficient to understanding society, because actors are embedded in the context of their actions and transactions. The ego/actor is an element, though a key one, in a system that includes relationships, forms of capital and innumerable other actors. He further recommends a *trans-actional* approach to understanding networks as dynamic, in a process rather than as static ties. This requires measuring change over time which requires in turn describing concepts and processes of interaction. Concepts out of context become meaningless, for example measuring freedom is meaningless, but measuring 'freedom to' or 'freedom from' is substantial and captures that elusive element of transaction. The concept of freedom emerges from something else; freedom to own property requires measures of property and ownership, or the concept emerges from other levels, an American tourist addressing a French shop keeper on an individual level, gains or suffers from macro level Franco-American relations, which verge into cultural capital. Even on the internal level, what Luhmann (1995) would call the psychic system, Emirbayer shows us that the ego emerges from a field of alters (Emirbayer and Goodwin 1994; Emirbayer 1997).

Analyzing social networks requires measuring and understanding actors, interactive relationships, and the process of relations. This is best accomplished with the use of *network visualizations* as an analysis of actors' patterns of stratification and *cluster analysis* where direct and indirect ties among actors are used to see embedded processes emerge from inter-connections. Any one concept can be best understood when compared to measures of related concepts, and in a temporal fashion (Emirbayer 1997). Temporality (change over time) reveals actors' agency through their engagement (reproduction and transformation) in structural environments. By measuring processes it is possible to reveal how actors took the past, imagined possible futures, and chose the (hopefully) best outcome (Emirbayer, 1998, p. 970).

Social Systems

Coleman (1990) developed a theory of social systems to address actions that don't fit with rational exchange theory. He uses normative theory, which is the idea that people change their behavior to comply with societal norms. Coleman (1988) theorizes that norms are the mechanism keeping groups solid because normative actions are exchanged for access to resources. Lin (2001) theorizes that norms are used by groups to protect assets and build homophily. The cost of maintaining norms within the group is very important. In a series of reactions to one another's ideas, Lin and Coleman evolve the idea that people make exchanges in search of better outcomes by considering the *actor* making the exchange within the context of their social system. Their motivations are sensible in light of group normative pressures and the role of participation within the larger system.

In consideration of the exact nature of social systems, Luhmann (1990, 1993, 1995) contends that society is Autopoietic (self-maintaining). He holds that social order is a system of constant negotiation of borders, carried out through the exchange of *meaning*, back and forth among actors. In response to the contentious issue of whether the exchanges are formative of the actors natures, (positions in the system are more important than the individuals occupying them) or if the actors form and determine the relationships, (the actors unique identities form the system), he contends that one can not exist without the other. This is an absolutely key idea. It is obvious to an uninformed observer, going to surface validity, that a person is the product of their environment. It is also clear that the people in a position change the position by their unique presence; the new boss is not necessarily the same as the old boss, and so agency is maintained.

A unique model of social systems emerges from this viewpoint which is useful in applying the concepts of social capital. Social systems engaged in the exchange of social capital must consist of actors, making the exchanges, and connections among those actors,

across which the exchanges can be made. According to Lin (2001), the social nature of the system is primarily motivated by the need to preserve existing assets and secondarily by the desire to extend access to assets. But, in an effort to do so, people constantly take actions that risk the loss of those assets. Failure to acquire further assets can even result in the loss of extant assets. In reality, absolute safety is unachievable; risk minimization becomes the primary means of asset protection (Luhmann, 1993). Actors in networks have limited perspectives. The key to minimizing loss is good decision making, which is only possible with good information. So, a source of information that can see network positions beyond the actor's immediately viewable area, or from a different point of view, is a valuable source of information. Luhmann calls that actor with a better perspective a *second order observer.*

By this way of understanding the system, we come to a place where people can attempt to be rational by trying to understand all of the risks they face. With limited knowledge of the network they live in, actors can act irrationally while attempting to compensate for unknowns. Therefore it is useful to have relationships with trusted people who have different perspectives on the system. Some assets may be offered in exchange for knowledge to preserve the greater part of the remainder of the assets, or to balance an uneven exchange of recognition of held assets (Luhmann 1993).

Generalized Trust

Trust is the expectation an actor holds that their actions on behalf of others will be reciprocated. Generalized trust is the expectation that reciprocity may come from a source other than the one for whom the initial action was taken, and may not go directly to the initial actor, but that taking action for members of the community have an eventual return. Generalized trust is sometimes called generalized reciprocity.

The internal structure of a social system typically is viewed as actors (individuals or groups) connected for some purpose (Granovetter, 1973; Simmel, 1955; Tönnies, 2001;

Frank, 1998). An actor's primary set of ties most influences with whom they interact frequently (Frank, 1998). The primary group is a field of all frequent ties, strong and weak, existing at a given point in time. The sociologist sorts out the actors and the ties that connect them then interprets what those actors and ties mean; what can be done to them to make for an equitable system.

The purpose of these ties is to mobilize resources, because different people have differential access to resources. Just like financial credit to purchase physical goods, a person may be able to get another person to mobilize a resource on their behalf, thus incurring a debt (Frank, 1998). But it is not necessarily an individual debt; rather it is a debt to the system to be repaid at some point elsewhere.

Actors are sub-systems. The actor takes meaning from the system and compares it to memories (historic meanings) then alters it and reintroduces it to the system. Meaning is an asset to exchange across connections. Meaning is the embodiment of network resources (Luhamnn, 1995).

Network exchanges happen as exchanges of meaning. Actors offer information into the system to redefine some part of the system as more or less of a risk. Greater knowledge of risks is a valuable asset, to be exchanged for recognition of an actor's ownership of assets and position as well as for other assets (Luhamnn, 1995).

The information provided by a second order observer must be accurate and in the best interest of the ego-actor, or the second order observer won't be trusted in the future. In a network system every actor has the opportunity to be another actor's second order observer.

Actors serving as second order observers for multiple other actors in a community hierarchy become a part of the community field. Second order observers have the opportunity to acquire greater resources through dishonesty, but must maintain the trust of the other actors in the field or risk loosing their position. The formation of organizations allows for the creation of generalized trust as a minimal cost, which allows for set of trusted

second order observers, the field. Securing assets is the primary motivation in exchange systems, so this necessitates trustworthiness in second order observers and gives credence to the idea that a small representative body is an ideal form for a field to take (Luhmann, 1995; Putnam and Goss, 2002; Wilkinson, 1999).

Community Network Systems

Above, a self sufficient system, constantly negotiating various kinds of resources, is described. Information does not exist independently of the system that created it, and so its various expressions in research cannot be measured independently of the system (connections) and the actors (egos and alters) whose internal negotiation of meaning is as important as the external negotiations among actors. Society, and the forms of capital that serve as currency, are created by the self reference of communication consisting of information and understanding. The result is a common meaning, altering the structure of the society that created it (Luhmann, 1990).

Meaning, then, is created by further reference to formerly negotiated meanings. This happens temporally. New meanings constantly replace old ones. Groups share similar meanings for key assets as those meanings diverge from a wider population. A network system emerges from this shared meaning bounded by connected actors with consistent meaning. For instance, all people who feel a given place is a good environment in which to live are part of a shared system, and likely also be found in the same locality. The meaning applied to "a good place to live" would share, to various degrees, the common asset of a specific place. The people who share a meaning may not be in contact, but because of flows in the system, those people who are engaged with one another in the definition of a given meaning will likely come closer together in their shared meaning and that shared meaning will likely diverge from other groups which are not connected to them. Here we bring in the common systems concept of density and inter-connectedness leading to homogeneity

(Luhmann, 1990). Self identified interest groups must contribute to the field of which they are a part.

For Lin, Granovetter and Portes, networks are systems of interactions among people for the purpose of maintaining and accessing resources. Lin (2001), condensing the other's, treats interactions as patterns among actors which evolve as resource patterns linked in interaction patterns. Interaction patterns, observed as frequency and nature of contact, frame the structure of exchanges, or mobilizations, that happen in the context of those interactions. This process is motivated by a desire on the part of actors, first to maintain those resources and capitals they already hold, then to extend the holdings; minimize loss then maximize gain. This happens by seeking to use exchanges to legitimize claims to assets embedded in the network. Among equals, it is an exchange of recognition of one's assets for recognition of another's. In reality, one side typically has fewer resources and can offer less valuable recognition, and so needs to balance the equation; recognition of claims for recognition of claims plus something else, often legitimization of dominant power status. An example would be an actor paying taxes in exchange for being allowed to keep the remainder of their income. Lin also hypothesizes that social capital accumulates significantly faster than any other sort of capital but has higher costs associated with its use, and so interactions outside of a person's primordial family and local bonded extensions are carried out primarily for accessing social capital. This carries with it the understanding that social exchanges are primarily carried out for purposes of recognition in efforts to minimize loss (Lin, 2001).

Community in Fields

Brint (2001) has made the most complete recent reexamination of the concepts of gemeinschaft and gesellschaft. He defines community, gemeinschaft, as groups of people with common activities or beliefs constrained by affect, loyalty, common values or personal

concern, a lot like Wilkinson's (1970, 1999) fields. In these constraints that delineate community, motives are of key importance, as with Wilkinson's interest groups.

Brint (2001) then goes on to divide groups into a gemeinschaft typology based on whether the group is geographic or choice based, then activity based or belief based. Among choice groups the divisions include concentration in space and frequency of face-to-face interaction. Geographic groups are divided by frequency of interaction, but spatial concentration is assumed. These divisions can be useful in identifying which groups will be part of a social field.

Although Wilkinson's idea of fields parallels Simmel's (1955) view of society's group affiliations, Wilkinson envisioned the lines as less concrete than Simmel did. Lin (2001) uses the idea of fields as a way of bridging the conceptual divide between the units of individuals and groups, by way of fields of institutions in networks. Wilkinson saw the community field, a particular social field that is focused on local community (the place where most needs are met) based needs as being gemeinschaft-like, at least on the surface, though exhibiting many gesellschaft-like features underneath. Wilkinson (1999, p. 16) provides a ray of hope that locality-based frequent interaction can build gemeinschaft-like bonds that transcend rationality. This is partially because locality increases homogeneity. If an actor's extra-local bonds are too numerous then there is a strong temptation to leave as a response to the psychological cost of maintaining extra-local ties, which tend to be vertical and bridging. It is easier for asset-rich actors to maintain bridges, and so further their local power. Granovetter (1973) devised the weak-strong continuum of ties to be determined by frequency, intensity, intimacy and reciprocity. The ease with which asset-rich actors maintain bridges is partially because the locality based community ties can be weak, relative to other ties (Warren, 1973) when placed along the weak-strong continuum. In those respects it is often the case that the strongest ties will be vertical and the weakest will be horizontal.

Hierarchies in Networks

The number of levels there are in a hierarchy effects the relative distribution of resource across the hierarchy, as well as the size of each level. A hierarchy with many levels has a large effect by level. A hierarchy with fewer levels has a lesser effect by level. This means that two actors, one closer to the top and the other closer to the bottom of a hierarchy, are likely to have more similar access to resources in a hierarchy with few levels than in a hierarchy with many levels. In a hierarchy with fewer levels, two random actors are more likely to have similar access than in a hierarchy with more levels. (Lin, 2001)

Lin showed that social capital was not as useful for actors at lower levels of an income hierarchy in getting better jobs (Lin, 2001; Lai, Lin and Leung, 1998). Silverman (2001) finds that reliance on social connections for job acquisition among low class (hierarchically speaking) populations leads to low paying jobs.

Historically, differential access to technology has enhanced human capital (colonialism) and caused an imbalance in control of resources (forced recognition of claims on assets.) Those claims have lasted as individual property rites and social capital into the modern age. Once a stable hierarchy is established, it becomes possible to try to change the structure of the hierarchy, but historical conditions are the most important factor in predicting outcomes (Lin, 2001).

Hierarchies form along lines of access to capital of all sorts. The actor with the most access to a particular resource tops that hierarchy. The actor with the least direct access, but still able to mobilize the asset, is at the bottom (Uzzi and Gillespie, 1999). Hierarchy tends to have fewer actors at the top level than at lower levels (Lin, 1999a).

Measurement Issues

Validity and Reliability

Sociologists continue to debate the nature of social capital and how to measure it. There are also discussions about the exact nature of fields. I have contributed to those discussions, but until research scholars agree upon a common definition of key terms, there will always be doubts as to the validity of using any definition.

Though it is my contention here that the network is the home of social capital and multiple memberships in related organizations indicates greater social capital, as well as revealing the presence of a field, there is need in future research for inclusion of positions within and among organizations. Even if no common definition can be arrived at soon, it should be possible to increase future external validity of similar efforts to this one, by including greater amounts of information about the natures of the interactions that constitute the relationships that I have referred to simply as memberships.

Internal validity is most suspect here when considering the differences in demographics and other variables between Meadville and Hillside, though previous research with these data has addressed most of those issues adequately. (Agnitsch, 2003) This could be addressed by using more advanced statistical methods than my level of expertise allows, though this should be the easiest of all things to correct for in future efforts.

Limitations and Opportunities

The small number of communities and their purposive selection makes generalization of the results difficult. The limitation of actors to membership in three groups limited the use of the membership lattice. Network analysis techniques favor a small population, though with the introduction of membership lattice techniques it should be possible explore larger populations.

This effort is further limited by the inability, at this point, for social network theory to explain greater variations observed in communities. This is an early work in a young field. In the coming years we will approach a single technique that serves well in all cases. This will necessitate advancements in theory as well as advancement in techniques for gathering data. Particularly, measures involving the average size and the level of association among actors in groups in relation to the number of groups being connected, in the community field, should reveal a great deal.

The biggest theoretical issue I see is in accounting for leadership and positionality within and among groups. Ethnographers observe that actors can position themselves to gain more social capital through key positions in key groups. There are cases where less involved actors are more endowed with social capital than more involved actors. If an actor takes on a leadership role within an organization that is entirely within the community field they would have a disproportionally powerful position as compared to other positions that may hold numerically greater leadership. I believe this can be accounted for by eliminating members of single organizations in larger populations, and weighing positions within organizations appropriately. It is an issue with rich opportunity for future work.

Theoretical Contributions

That a community field is made up of the instances of overlapping membership in community oriented interest organizations, is a powerful idea for empirical use. The idea of the community field is sociologically interesting and should be a part of network analysis, but without the use of lattices to bring together network theory and social capital, its location had not been empirically proven

.A set of empirical definitions for community fields, along with a set of measures defining network ties, is important. The ability to devise further measures for network

structures, using a set of member lattices, which can then be consistently compared among communities of all sizes and varieties, is an important tool.

An important the idea underlies this entire thesis is that all social measures must be relative to the immediate community. It has long been a rule in other scientific fields that absolutes are elusive, or nonexistent, but that valuable measures must be relative to something. In community studies, all measures should be held relative to the local community where they were taken. That is why all of the measures were designed to be expressed by numbers ranging from zero to one. That way, any two communities can be compared, while both are being held relative to their own localities.

Methodological Contributions

This thesis makes a major methodological contribution by suggesting a simple and reliable way to identify a community field. Further research will be necessary to show how well this technique can be applied to larger populations, and whether it can be used to incorporate the presence of leaders, and other descriptions of position, within groups. The analysis of the data presented in chapter four gives credence to the generalizability of the member lattice analysis method.

This thesis begins to develop a way to analyze the internal structure of a community field for the presence of various sorts of social capital. The use of lattice structures in social analysis is not a new thing. In fact is goes back several decades, yet despite its clear power in recognizing and demonstrating structural relationships, it has not risen to a prominence in the field. I suspect this is in part due to the complex mathematics that have traditionally accompanies the use of lattices and the under-development of social sciences software for this purpose. I am hopeful that the techniques outlined here, which do not necessitate the use of complicated formulae, will make some progress toward correcting this condition.

Ultimately, this thesis laid the groundwork for developing network analysis techniques to look at social capital. Those techniques grow out of sociological theory, in opposition to previous techniques which came from network analysis and only later were given sociological significance.

APPENDIX

Table 3.2 - Hillside, One-Mode, Binary, Actors

Actors	1000	1006	1008	1011	1017	1019	1027	1028	1029	1043	1044	1046	1053	1054	1070	1073	1076	1082	1083	1089	1091	1092	1104	1105	1107
1000	1	0	1	1	0	1	0	0	1	0	1	1	1	0	0	1	1	0	1	1	1	0	0	1	1
1006	0	1	0	1	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
1008	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0
1011	1	1	0	1	1	1	1	0	1	1	1	0	1	0	1	0	1	0	1	1	0	1	0	1	1
1017	0	1	0	1	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
1019	1	0	0	1	0	1	0	0	1	0	1	0	1	0	0	0	1	0	1	1	0	0	0	1	1
1027	0	1	0	1	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
1028	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0
1029	1	0	0	1	0	1	0	0	1	0	1	0	1	0	0	0	1	0	1	1	0	0	0	1	1
1043	0	1	0	1	1	0	1	1	0	1	0	0	0	0	1	0	1	0	0	1	0	1	1	0	0
1044	1	0	0	1	0	1	0	0	1	0	1	0	1	0	0	0	1	0	1	1	0	0	0	1	1
1046	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0
1053	1	0	0	1	0	1	0	0	1	0	1	0	1	0	0	0	1	0	1	1	0	0	0	1	1
1054	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
1070	0	1	0	1	1	0	1	1	0	1	0	0	0	0	1	0	1	0	0	1	0	1	1	0	0
1073	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0
1076	1	0	0	1	0	1	0	1	1	1	1	0	1	0	1	0	1	0	1	1	0	0	1	1	1
1082	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
1083	1	0	0	1	0	1	0	0	1	0	1	0	1	0	0	0	1	0	1	1	0	0	0	1	1
1089	1	1	0	1	1	1	1	0	1	1	1	0	1	0	1	0	1	0	1	1	0	1	0	1	1
1091	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0
1092	0	1	0	1	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
1104	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0
1105	1	0	0	1	0	1	0	0	1	0	1	0	1	0	0	0	1	0	1	1	0	0	0	1	1
1107	1	0	0	1	0	1	0	0	1	0	1	0	1	0	0	0	1	0	1	1	0	0	0	1	1
1111	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
1113	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
1115	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0
1120	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
1125	0	1	0	1	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
1126	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0
1129	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
1130	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
1137	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0
1145	1	0	0	1	0	1	0	0	1	0	1	0	1	0	0	0	1	0	1	1	0	0	0	1	1
1150	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	1	1	0	0	0	0	1	0	0
1154	1	0	0	1	0	1	0	0	1	0	1	0	1	0	0	0	1	0	1	1	0	0	0	1	1
1166	1	0	1	1	0	1	0	0	1	0	1	1	1	0	0	1	1	0	1	1	1	0	0	1	1
1169	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0
1178	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
1180	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	1	1	0	0	0	0	1	0	0
1185	0	1	0	1	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
1187	1	0	1	1	0	1	0	0	1	0	1	1	1	0	0	1	1	0	1	1	1	0	0	1	1
1190	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	1	1	0	0	0	0	1	0	0
1195	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
1196	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	1	1	0	0	0	0	1	0	0

Actors

Table 3.2 (continued)

Actors	1111	1113	1115	1120	1125	1126	1129	1130	1137	1145	1150	1154	1166	1169	1178	1180	1185	1187	1190	1195	1196
1000	0	0	1	0	0	0	0	1	1	1	0	1	1	1	0	0	0	1	0	0	0
1006	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
1008	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	0	0
1011	0	0	0	0	1	0	0	0	0	1	0	1	1	0	0	0	1	1	0	0	0
1017	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
1019	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	0	0
1027	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
1028	0	0	0	0	0	1	1	1	0	0	1	0	0	0	0	1	0	0	1	0	1
1029	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	0	0
1043	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	1	1	0	1	0	1
1044	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	0	0
1046	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	0	0
1053	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	0	0
1054	1	1	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	1	1
1070	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	1	1	0	1	0	1
1073	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	0	0
1076	0	0	0	0	0	1	1	1	0	1	1	1	1	0	0	1	0	1	1	0	1
1082	1	1	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	1	1
1083	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	0	0
1089	0	0	0	0	1	0	0	0	0	1	0	1	1	0	0	0	1	1	0	0	0
1091	0	0	1	0	0	0	0	1	1	0	0	0	1	1	0	0	0	1	0	0	0
1092	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
1104	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	1
1105	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	0	0
1107	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	0	0
1111	1	1	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	1	1
1113	1	1	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	1	1
1115	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	0	0
1120	1	1	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	1	1
1125	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
1126	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	1
1129	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0
1130	0	0	0	0	0	0	1	1	1	0	0	0	1	1	0	0	0	1	1	0	0
1137	0	0	1	0	0	0	0	1	1	0	0	0	1	1	0	0	0	1	0	0	0
1145	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	0	0
1150	1	1	0	1	0	1	0	0	0	0	1	0	0	0	1	1	0	0	1	1	1
1154	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	0	0
1166	0	0	1	0	0	0	0	1	1	1	0	1	1	1	0	0	0	1	0	0	0
1169	0	0	1	0	0	0	0	1	1	0	0	0	1	1	0	0	0	1	0	0	0
1178	1	1	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	1	1
1180	1	1	0	1	0	1	0	0	0	0	1	0	0	0	1	1	0	0	1	1	1
1185	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
1187	0	0	1	0	0	0	0	1	1	1	0	1	1	1	0	0	0	1	0	0	0
1190	1	1	0	1	0	1	1	1	0	0	1	0	0	0	1	1	0	0	1	1	1
1195	1	1	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	1	1
1196	1	1	0	1	0	1	0	0	0	0	1	0	0	0	1	1	0	0	1	1	1

Table 3.3 – Meadville, One-Mode Binary, Actors.

Actors	3	7	8	10	25	27	30	38	41	45	46	52	54	55	63	67	69	83	89	90	91	94	96	97	100
3	1	1	0	1	1	1	1	0	1	0	0	1	1	1	0	1	0	1	1	0	1	0	0	1	1
7	1	1	0	1	0	1	1	0	1	0	0	1	1	0	0	1	0	0	1	0	1	0	0	1	1
8	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	1	0	0
10	1	1	0	1	0	1	1	0	1	0	0	1	1	0	0	1	0	0	1	0	1	0	0	1	1
25	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0
27	1	1	0	1	1	1	0	0	1	0	0	0	1	1	0	0	0	1	1	0	1	0	0	1	1
30	1	1	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1
38	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
41	1	1	0	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	1
45	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	1	0	0
46	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	1	0	0
52	1	1	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1
54	1	1	0	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	1
55	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
67	1	1	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1
69	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
83	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0
89	1	1	0	1	1	1	1	0	1	0	0	1	1	1	0	1	0	1	1	0	1	0	0	1	1
90	0	0	1	0	0	0	0	1	0	1	1	0	0	0	1	0	1	0	0	1	0	1	0	0	0
91	1	1	0	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	1
94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
96	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
97	1	1	0	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	1
100	1	1	0	1	0	1	1	0	1	0	0	1	1	0	0	1	0	0	1	0	1	0	0	1	1
101	1	1	0	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	1
102	1	1	0	1	1	1	0	0	1	0	0	0	1	1	1	0	0	1	1	1	1	1	0	1	1
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
115	1	1	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1
123	1	1	0	1	0	1	1	0	1	0	0	1	1	0	0	1	0	0	1	0	1	0	0	1	1
139	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
143	1	1	0	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	1
149	1	1	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1
154	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
166	0	0	1	0	0	0	0	1	0	1	1	0	0	0	1	0	1	0	0	1	0	1	0	0	0
167	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
171	1	1	0	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	1
174	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
182	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
185	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0
187	0	0	1	0	0	0	0	1	0	1	1	0	0	0	1	0	1	0	0	1	0	1	0	0	0
200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
207	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
212	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0

Table 3.3 (continued - part 2)

Actors

Actors	101	102	105	111	115	123	139	143	149	154	166	167	171	174	175	182	185	187	200	207	212	215	216	219	225
3	1	1	0	0	1	1	0	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
7	1	1	0	0	1	1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1
10	1	1	0	0	1	1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
25	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
27	1	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
30	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1
41	1	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1
46	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1
52	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	1	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
55	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
63	0	1	1	1	0	0	0	0	0	0	1	1	0	1	1	1	0	1	1	0	0	0	0	1	0
67	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1
83	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
89	1	1	0	0	1	1	0	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
90	0	1	1	1	0	0	1	0	0	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1
91	1	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
94	0	1	1	1	0	0	0	0	0	0	1	1	0	1	1	1	0	1	1	0	0	0	0	1	0
96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	1	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
100	1	1	0	0	1	1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
101	1	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
102	1	1	1	1	0	1	0	1	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	1	0
105	0	1	1	1	0	0	0	0	0	0	1	1	0	1	1	1	0	1	1	0	0	0	0	1	0
111	0	1	1	1	0	0	0	0	0	0	1	1	0	1	1	1	0	1	1	0	0	0	0	1	0
115	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
123	1	1	0	0	1	1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
139	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1
143	1	1	0	0	0	1	0	1	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
149	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
154	0	0	0	0	0	0	1	1	0	1	1	0	0	1	0	0	0	1	0	1	1	1	1	0	1
166	0	1	1	1	0	0	1	0	0	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1
167	0	1	1	1	0	0	0	0	0	0	1	1	0	1	1	1	0	1	1	0	0	0	0	1	0
171	1	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
174	0	1	1	1	0	0	0	1	0	1	1	1	0	1	1	1	0	1	1	0	0	0	0	1	0
175	0	1	1	1	0	0	0	0	0	0	1	1	0	1	1	1	0	1	1	0	0	0	0	1	0
182	0	1	1	1	0	0	0	0	0	0	1	1	0	1	1	1	0	1	1	0	0	0	0	1	0
185	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
187	0	1	1	1	0	0	1	0	0	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1
200	0	1	1	1	0	0	0	0	0	0	1	1	0	1	1	1	0	1	1	0	0	0	0	1	0
207	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1
212	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1

Table 3.3 (continued - part 3)

Actors

Actors	233	234	235	237	238	243	244	246	254	263	268	273	276	281	286	291	293	295	298	300
3	0	1	1	1	1	0	1	0	0	1	1	1	0	1	1	0	0	0	0	0
7	0	1	0	0	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0
8	1	0	0	0	0	1	0	1	1	0	1	0	1	0	0	0	1	1	1	0
10	0	1	0	0	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0
25	0	0	1	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0
27	0	1	1	1	1	0	1	0	0	1	0	0	0	1	1	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
38	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	1	0
41	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
45	1	0	0	0	0	1	0	1	1	0	1	0	1	0	0	0	1	1	1	0
46	1	0	0	0	0	1	0	1	1	0	1	0	1	0	0	0	1	1	1	0
52	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
54	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
55	0	0	1	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0
63	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
67	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
69	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	1	0
83	0	0	1	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0
89	0	1	1	1	1	0	1	0	0	1	1	1	0	1	1	0	0	0	0	0
90	1	0	1	0	0	1	0	1	0	0	0	0	1	0	0	1	1	1	1	1
91	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
94	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
96	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0
97	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
100	0	1	0	0	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0
101	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
102	0	1	1	1	1	0	1	0	0	1	0	0	0	1	1	1	0	0	0	1
105	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
111	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
115	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
123	0	1	0	0	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0
139	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	1	0
143	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
149	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
154	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	1	0
166	1	0	1	0	0	1	0	1	0	0	0	0	1	0	0	1	1	1	1	1
167	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
171	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
174	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
175	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
182	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
185	0	0	1	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0
187	1	0	1	0	0	1	0	1	0	0	0	0	1	0	0	1	1	1	1	1
200	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
207	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	1	0
212	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	1	0

Table 3.3 (continued - part 4)

Actors

Actors	3	7	8	10	25	27	30	38	41	45	46	52	54	55	63	67	69	83	89	90	91	94	96	97	100
215	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
216	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
219	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
225	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
233	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
234	1	1	0	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	1
235	1	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0	1	1	1	0	1	0	0	0
237	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0
238	1	1	0	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	1
243	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
244	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0
246	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	1	0	0
254	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
263	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0
268	1	1	1	1	0	0	1	0	0	1	1	1	0	0	0	1	0	0	1	0	0	0	1	0	1
273	1	1	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1
276	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
281	1	1	0	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	1
286	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0
291	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
293	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
295	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
298	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0

Table 3.3 (continued - part 5)

Actors

Actors	101	102	105	111	115	123	139	143	149	154	166	167	171	174	175	182	185	187	200	207	212	215	216	219	225
215	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1
216	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1
219	0	1	1	1	0	0	0	0	0	0	1	1	0	1	1	1	0	1	1	0	0	0	0	1	0
225	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1
233	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1
234	1	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
235	0	1	1	1	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	0	0	0	0	1	0
237	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
238	1	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
243	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1
244	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
246	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1
254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
263	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
268	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
273	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
276	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1
281	1	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
286	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
291	0	1	1	1	0	0	0	0	0	0	1	1	0	1	1	1	0	1	1	0	0	0	0	1	0
293	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1
295	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1
298	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1
300	0	1	1	1	0	0	0	0	0	0	1	1	0	1	1	1	0	1	1	0	0	0	0	1	0

Table 3.3 (continued - part 6)

Actors

Actors	233	234	235	237	238	243	244	246	254	263	268	273	276	281	286	291	293	295	298	300
215	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	1	0
216	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	1	0
219	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
225	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	1	0
233	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	1	0
234	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
235	0	0	1	1	0	0	1	0	0	1	0	0	0	0	1	1	0	0	0	1
237	0	0	1	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0
238	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
243	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	1	0
244	0	0	1	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0
246	1	0	0	0	0	1	0	1	1	0	1	0	1	0	0	0	1	1	1	0
254	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0
263	0	0	1	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0
268	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0
273	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
276	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	1	0
281	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
286	0	0	1	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0
291	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
293	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	1	0
295	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	1	0
298	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	1	0
300	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1

Table 3.4 – Hillside, Two-Mode, Binary, Actors and Projects.

Actors	Projects						
	Annex	Ovrpss	S.Cntr	A. Cntr.	1. Rcrt.	C. Fnd.	S. Bnd
1000	1	1	0	1	0	0	0
1006	0	0	0	0	0	0	1
1008	1	0	0	0	0	0	0
1011	0	0	0	1	0	0	1
1017	0	0	0	0	0	0	1
1019	0	0	0	1	0	0	0
1027	0	0	0	0	0	0	1
1028	0	0	0	0	1	1	0
1029	0	0	0	1	0	0	0
1043	0	0	0	0	0	1	1
1044	0	0	0	1	0	0	0
1046	1	0	0	0	0	0	0
1053	0	0	0	1	0	0	0
1054	0	0	1	0	0	0	0
1070	0	0	0	0	0	1	1
1073	1	0	0	0	0	0	0
1076	0	0	0	1	1	1	0
1082	0	0	1	0	0	0	0
1083	0	0	0	1	0	0	0
1089	0	0	0	1	0	0	1
1091	1	1	0	0	0	0	0
1092	0	0	0	0	0	0	1
1104	0	0	0	0	0	1	0
1105	0	0	0	1	0	0	0
1107	0	0	0	1	0	0	0
1111	0	0	1	0	0	0	0
1113	0	0	1	0	0	0	0
1115	1	0	0	0	0	0	0
1120	0	0	1	0	0	0	0
1125	0	0	0	0	0	0	1
1126	0	0	0	0	0	1	0
1129	0	0	0	0	1	0	0
1130	0	1	0	0	1	0	0
1137	1	1	0	0	0	0	0
1145	0	0	0	1	0	0	0
1150	0	0	1	0	0	1	0
1154	0	0	0	1	0	0	0
1166	1	1	0	1	0	0	0
1169	1	1	0	0	0	0	0
1178	0	0	1	0	0	0	0
1180	0	0	1	0	0	1	0
1185	0	0	0	0	0	0	1
1187	1	1	0	1	0	0	0
1190	0	0	1	0	1	1	0
1195	0	0	1	0	0	0	0
1196	0	0	1	0	0	1	0

Table 3.5 – Meadville, Two-Mode, Binary, Actors and Projects.

Actors	Projects: Mead Days	Grocery Store	Resource Center	Teen Center	Bicycle Trail	Mead Days Garden	Law Enforcement
3	0	0	1	0	1	0	1
7	0	0	0	0	1	0	1
8	1	0	0	0	0	1	0
10	0	0	0	0	1	0	1
25	0	0	1	0	0	0	0
27	0	0	1	0	1	0	0
30	0	0	0	0	0	0	1
38	1	0	0	0	0	0	0
41	0	0	0	0	1	0	0
45	1	0	0	0	0	1	0
46	1	0	0	0	0	1	0
52	0	0	0	0	0	0	1
54	0	0	0	0	1	0	0
55	0	0	1	0	0	0	0
63	0	0	0	1	0	0	0
67	0	0	0	0	0	0	1
69	1	0	0	0	0	0	0
83	0	0	1	0	0	0	0
89	0	0	1	0	1	0	1
90	1	0	0	1	0	0	0
91	0	0	0	0	1	0	0
94	0	0	0	1	0	0	0
96	0	0	0	0	0	1	0
97	0	0	0	0	1	0	0
100	0	0	0	0	1	0	1
101	0	0	0	0	1	0	0
102	0	0	1	1	1	0	0
105	0	0	0	1	0	0	0
111	0	0	0	1	0	0	0
115	0	0	0	0	0	0	1
123	0	0	0	0	1	0	1
139	1	0	0	0	0	0	0
143	0	1	0	0	1	0	0
149	0	0	0	0	0	0	1
154	1	1	0	0	0	0	0
166	1	0	0	1	0	0	0
167	0	0	0	1	0	0	0
171	0	0	0	0	1	0	0
174	0	1	0	1	0	0	0
175	0	0	0	1	0	0	0
182	0	0	0	1	0	0	0
185	0	0	1	0	0	0	0
187	1	0	0	1	0	0	0
200	0	0	0	1	0	0	0
207	1	0	0	0	0	0	0
212	1	0	0	0	0	0	0
215	1	0	0	0	0	0	0
216	1	0	0	0	0	0	0
219	0	0	0	1	0	0	0
225	1	0	0	0	0	0	0
233	1	0	0	0	0	0	0

Table 3.5 (continued)

Actors	Projects: Mead Days	Grocery Store	Resource Center	Teen Center	Bicycle Trail	Mead Days Garden	Law Enforcement
234	0	0	0	0	1	0	0
235	0	0	1	1	0	0	0
237	0	0	1	0	0	0	0
238	0	0	0	0	1	0	0
243	1	0	0	0	0	0	0
244	0	0	1	0	0	0	0
246	1	0	0	0	0	1	0
254	0	0	0	0	0	1	0
263	0	0	1	0	0	0	0
268	0	0	0	0	0	1	1
273	0	0	0	0	0	0	1
276	1	0	0	0	0	0	0
281	0	0	0	0	1	0	0
286	0	0	1	0	0	0	0
291	0	0	0	1	0	0	0
293	1	0	0	0	0	0	0
295	1	0	0	0	0	0	0
298	1	0	0	0	0	0	0
300	0	0	0	1	0	0	0

Table 3.6 – Hillside, One-Mode, Weighted, Projects.

Projects	Land Annex	Hwy Ovrpss	Snr Cntr	Aqua Cntr	Ind Recruit	Comm Found	Schl Bond
Land Annex							
Hwy Ovrpss	6						
Snr Cntr	0	0					
Aqu Cntr	3	3	0				
Ind Recruit	0	1	1	2			
Comm Found	0	0	4	2	2		
Schl Bond	0	0	0	2	0	2	

Table 3.7 – Meadville, One-Mode, Weighted, Projects.

Projects	Mead Days	Grcry Store	Rsrc Center	Teen Center	Bike Trail	Mead D. Garden	Law Enf
Mead Days							
Grcry Store	1						
Rsrc Center	0	0					
Teen Center	3	1	2				
Bike Trail	0	1	4	1			
Mead D Garden	4	0	0	0	0		
Law Enf	0	0	2	0	6	1	

Table 3.8 – Hillside, One-Mode, Weighted, Actors.

Actors	1000	1006	1008	1011	1017	1019	1027	1028	1029	1043	1044	1046	1053	1054	1070	1073	1076	1082	1083	1089	1091	1092	1104	1105	1107
1000	3		1	1								1	1			1	1		1		3			1	1
1006		1								1										1		1			
1008			1								1					1					1				
1011				2	1				1				1				1		1	1		1		1	
1017		1		1	1					1										1		1			
1019						1							1				1		1						1
1027				1			1															1			
1028	1							2		1					2		2								
1029									1								1			1					
1043	1	1						1		2					1		1			1		1	1		
1044											1		1				1		1						1
1046												1													
1053				1		1			1		1		1				1			1				1	1
1054									1					1				1							
1070				1				1		1					2		1			1		1	1		
1073			1													1					1				
1076				1				2	1	1	1		1		2		3		1	1			1	1	1
1082									1					1				1							
1083	1												1						1					1	1
1089				1	1		1	1	1		1		1		1		1		1	2		1		1	1
1091	1		1													1					2				
1092		1					1			1										1		1			
1104								1		1							1						1		
1105	1					1					1		1				1		1					1	1
1107						1					1		1				1		1					1	1
1111									1					1				1							
1113																		1							
1115																									
1120									1					1				1							
1125										1					1					1		1			
1126								1		1					1		1						1		
1129								1							1		1								
1130	2																								
1137	1																				1				
1145				1					1		1		1				1		1	1				1	
1150																		1							
1154											1		1				1		1						1
1166	1		1	1									1			1	1		1		2				
1169	1		1													1					1				
1178																									
1180	1							1	1	1				1	1			1					1		
1185		1		1																		1			
1187			1													1	1		1		2				1
1190								1							1		1	1					1		
1195									1									1							
1196								1		1					1										

Table 3.8 (continued)

Actors	1111	1113	1115	1120	1125	1126	1129	1130	1137	1145	1150	1154	1166	1169	1178	1180	1185	1187	1190	1195	1196
1000									2	1	1		2	3				3			
1006																					
1008								1					1	1				1			
1011									1	1			1				1				
1017																					
1019										1											
1027						1															
1028							1	1		1											1
1029																		1			
1043					1	1				1						1		1			1
1044								1		1		1									
1046									1				1								
1053								1		1		1	1								
1054	1	1		1							1		1							1	
1070										1									1		
1073													1	1				1			
1076	1					1	1	2		1		1	1					1			
1082				1							1					1					
1083																					
1089									1	1		1									
1091									2				1	2				2			
1092																					
1104								1		1									1		
1105													1								
1107										1		1						1			
1111	1	1		1							1					1				1	
1113	1	1		1							1					1				1	
1115			1																		
1120	1	1		1							1					1			1	1	
1125					1																
1126						1				1						1					
1129							1	1													
1130							1	2	1									1			
1137			1					2	2				1	2				2			
1145								1		1		1									
1150	1	1		1							2	1			1	2			1	1	
1154										1		1									
1166									1	1	1		3	2				2			
1169									1				1	2				2			
1178	1	1									1				1	1			1	1	
1180	1			1		1					2		1			2			1	1	1
1185					1												1				
1187			1					2	2				3	2				3			
1190		1				1		1	2	1	1					1			3	1	
1195	1	1		1							1				1	1			1	1	1
1196		1						1			1					1		1		1	2

Table 3.9 – Meadville, One-Mode, Weighted, Actors.

Actors	3	7	8	10	25	27	30	38	41	45	46	52	54	55	63	67	69	83	89	90	91	94	96	97	100
3	3	2		2		2	2									2		1	2						2
7	2	2		1		2													1						2
8			2							1	2									1			1		
10	1	1		2		1	1					1	1			2			1		1				2
25					1	1	1											1							
27	2	1				2	1	1	1									1	1					1	
30	1	1		1			1					1							1						
38								1									1								
41						1			1																
45			2							2	2					1	1			2			1		
46			1							2	2					1				1					
52												1													
54				1		1							1												
55														1											
63															1										
67		1					1									1			1						1
69								1									1								
83	1					1												1	1						
89		1		1		1	1									1			3						1
90			1					1			1									2					
91		1		1		1	1									1			1		1				1
94																						1			
96			1								1												1		
97		1				1	1									1			1					1	1
100	1	1		1		1										1			1						2
101						1													1						
102		1				2	1							1				1	1						1
105															1					1					
111															1							1			
115	1	1		1			1									1			1						1
123				2		1										2									2
139								1									1			1					
143				1		1							1												
149	1	1		1			1									1			1						1
154								1									1			1					
166								1			1									1					
167						1														1					
171	1	1				1	1												1						1
174																									
175																									
182															1										
185					1	1						1						1							
187								1		1	1											1			
200																						1			
207										1							1			1					
212								1			1														
215								1			1														
216											1														

Table 3.9 (continued - part 2)

Actors	3	7	8	10	25	27	30	38	41	45	46	52	54	55	63	67	69	83	89	90	91	94	96	97	100
219															1										
225								1		1	1						1			1					
233								1		1															
234				1		1																			
235					1													1	1						
237						1													1						
238	1	1		1		1							1						1						
243																	1			1					
244	1					1								1					1						
246			2							2	2									1	1				
254			1								1					1									
263					1	1																			
268			1	1							1					2									
273		1														1			1						1
276								1			1														
281		1		1		1	1						1						1						
286					1	1								1				1							
291					1																				
293								1																	
295								1		1										1					
298											1									1					
300																						1			

Actors

Table 3.9 (continued - part 3)

Actors	101	102	105	111	115	123	139	143	149	154	166	167	171	174	175	182	185	187	200	207	212	215	216	219	225
3	1	0	0	0	1	2	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
10	0	0	0	0	1	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	1	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	1	0	0	0	0	1
46	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1
52	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
55	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0
67	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	1	0	1
83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
90	0	1	0	0	0	0	1	0	0	1	2	0	0	1	1	0	0	2	1	0	1	0	0	1	0
91	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0
96	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
100	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
101	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
102	0	3	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0	0	0	0	1	0
105	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0
111	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	0
115	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
123	0	0	0	0	0	2	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
139	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1
143	0	0	0	0	0	0	0	2	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
149	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
154	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0
166	0	0	0	0	0	0	1	0	0	1	2	1	0	1	0	0	0	0	1	1	0	0	0	0	0
167	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1	1	0	0	0	0	0	0
171	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
174	0	0	0	0	0	0	0	1	0	1	0	1	0	2	0	0	0	0	1	0	0	0	0	1	0
175	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0
182	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	1	0
185	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
187	0	0	1	1	0	0	0	0	0	0	1	0	0	1	0	0	0	2	1	0	0	0	0	1	1
200	0	1	1	1	0	0	0	0	0	0	1	1	0	1	1	1	0	1	1	0	0	0	0	1	0
207	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1
212	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
215	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1
216	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0

Table 3.9 (continued - part 4)

Actors	101	102	105	111	115	123	139	143	149	154	166	167	171	174	175	182	185	187	200	207	212	215	216	219	225
219		1	1	1							1		1	1					1					1	
225							1			1	1									1	1	1	1		1
233							1			1	1							1							1
234													1												
235		2																	1					1	
237																	1								
238								1					1												
243										1															1
244		1															1								
246							1			1	1									1					1
254																									
263																									
268																									
273					1																				
276							1			1	1									1	1				1
281													1												
286																									
291		1									1	1		1					1					1	
293																					1	1			
295							1			1					1			1			1	1	1		1
298										1								1		1					
300			1									1		1	1	1			1						

Table 3.9 (continued - part 5)

Actors	233	234	235	237	238	243	244	246	254	263	268	273	276	281	286	291	293	295	298	300
3				1		1	1			1		2								
7											1	2								
8				2				1	1				1							
10												2		1						
25				1			1													
27		1		1			1			1	1				1					
30											1									
38	1					1							1							
41																				
45				1				2	1		1		1					1		
46				1				1	1		1		2							
52																				
54																				
55			1				1													
63																				1
67											1	1								
69											1		1						1	
83			1	1			1			1										
89			1	1			1				1	1								
90													1							1
91											1	1		1						
94																1				1
96				1				1	1											
97				1	1							1								
100					1						1	2								
101																				
102			1	1			1													1
105																1				1
111																				
115									1		1	1								
123												2								
139	1												1							
143																				
149											1									
154											1		1							
166													1						1	
167																				
171											1	1								
174																				
175																				
182						1														1
185				1			1			1										
187				1									1			1				1
200			1													1				1
207											1		1						1	
212	1												1				1			
215											1		1							
216													1							

Table 3.9 (continued - part 6)

Actors	233	234	235	237	238	243	244	246	254	263	268	273	276	281	286	291	293	295	298	300
219			1																	
225				1				1					1				1	1	1	
233	1										1		1				1	1		
234		1																		
235			2	1		1	1			1						2				
237				1			1			1										
238					1															
243						1							1							
244			1	1			1			1										
246				1				2	2									1	1	
254									1		1									
263				1			1			1					1					
268									1		2									
273												1								
276	1					1							1							
281														1						
286				1			1			1					1					
291																1				
293	1												1				1	1		
295													1				1	1		
298				1															1	
300																				1

Table 4.1 - Meadville Hierarchical Clustering Of Equivalence Matrix (from UCINET)

```
                                    Actor

          1 1       2   1 2   2 2 2 2   2 2 2 2 2 1 2 2   2
          6 8 9 4 4 4   5 1 3 2 4 1 9 6 3 0 9 9 1 3 7 5 9 6
          6 7 0 5 6 6 8 4 6 8 5 3 2 8 9 3 7 3 5 5 9 6 4 6 8
Level
-----     - - - - - - - - - - - - - - - - - - - - - - - - - -
0.000     XXXXX XXXXXXX . XXXXXXXXXXXXXXXXXXXXXXXXXX XXX .
2.000     XXXXX XXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXX XXX .
2.494     XXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXX .
3.464     XXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXX XX
3.742     XXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXX XX
3.787     XXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXX XX
4.722     XXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXX XX
5.172     XXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXX XX
5.385     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXX XX
5.562     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXXXXX
6.150     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXXXXX
6.570     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXXXXX
6.944     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXXXXX
7.392     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXXXXX
8.243     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

Table 4.1 - (continued)

Actor

	2		1		1					1			1	1	1		2		1	2			2	2	
	7	5	4	3	1	6	2	8		2		1	0	4	7	9	8	5	0	3	9	4	3	3	2
	3	2	9	0	5	7	7	9	3	3	7	0	0	3	1	1	1	4	1	8	7	1	4	7	5
Level																									
0.000	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.000	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.494	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3.464	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3.742	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3.787	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.722	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5.172	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5.385	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5.562	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6.150	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6.570	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6.944	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7.392	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8.243	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 4.1 - (continued - part 2)

Actor

	2		2	2	1	1	2	1	1	2	1	1	1		2		1	2	3
	8	5	8	6	4	8	0	3	7	8	1	6	0	7	9	9	6	1	0	0
	6	5	3	3	4	5	2	5	4	2	9	7	5	5	4	1	3	1	0	0
Level																				
0.000	X	X	X	X	X	X	X	X	X	X	.	.	.	X	X	X	X	X	X	X
2.000	X	X	X	X	X	X	X	X	X	X	.	.	X	X	X	X	X	X	X	X
2.494	X	X	X	X	X	X	X	X	X	X	.	.	X	X	X	X	X	X	X	X
3.464	X	X	X	X	X	X	X	X	X	X	.	.	X	X	X	X	X	X	X	X
3.742	X	X	X	X	X	X	X	X	X	X	.	.	X	X	X	X	X	X	X	X
3.787	X	X	X	X	X	X	X	X	X	X	.	.	X	X	X	X	X	X	X	X
4.722	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	X	X	X	X	X
5.172	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	X	X	X	X	X
5.385	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	X	X	X	X	X
5.562	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	X	X	X	X	X
6.150	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	X	X	X	X	X
6.570	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	X	X	X	X	X
6.944	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7.392	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8.243	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 4.2 - Hillside Hierarchical Clustering Of Equivalence Matrix (from UCINET)

```
                                    Actor

        1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
        1 1 0 0 0 1 1 1 0 0 0 0 0 1 1 1 0 0 0 1 0 1 1 0 0
        2 3 4 7 0 1 6 3 9 7 1 8 8 0 0 5 5 4 2 4 1 6 8 0 4
        9 0 6 3 8 5 9 7 1 6 1 9 3 5 7 4 3 4 9 5 9 6 7 0 3
Level
-----   - - - - - - - - - - - - - - - - - - - - - - - - - -
0.000   . . XXXXXXX XXXXX . XXX XXXXXXXXXXXXXXXXX XXXXX XX
1.414   . . XXXXXXXXXXXXX . XXX XXXXXXXXXXXXXXXXX XXXXX XX
2.000   . . XXXXXXXXXXXXX . XXX XXXXXXXXXXXXXXXXX XXXXX XX
3.464   XXX XXXXXXXXXXXXX . XXX XXXXXXXXXXXXXXXXX XXXXX XX
3.571   XXX XXXXXXXXXXXXX . XXX XXXXXXXXXXXXXXXXX XXXXX XX
4.000   XXX XXXXXXXXXXXXX . XXXXXXXXXXXXXXXXXXXX XXXXX XX
4.255   XXX XXXXXXXXXXXXX . XXXXXXXXXXXXXXXXXXXXXXXXXXX XX
4.257   XXX XXXXXXXXXXXXX . XXXXXXXXXXXXXXXXXXXXXXXXXXX XX
4.261   XXXXXXXXXXXXXXXXX . XXXXXXXXXXXXXXXXXXXXXXXXXXX XX
5.382   XXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXX XX
5.687   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XX
6.071   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XX
7.215   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

Table 4.2 - (continued)

```
                                    Actor

        1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
        0 1 1 0 0 0 0 0 1 1 0 1 1 1 0 1 1 1 1 1 1
        7 2 8 1 0 9 2 2 0 2 8 1 7 2 5 1 9 9 5 8 9
        0 5 5 7 6 2 7 8 4 6 2 1 8 0 4 3 5 0 0 0 6
Level
-----   - - - - - - - - - - - - - - - - - - - - - -
0.000   X XXXXXXXXXXX . XXX XXXXXXXXXXXXX . XXXXX
1.414   X XXXXXXXXXXX . XXX XXXXXXXXXXXXX . XXXXX
2.000   X XXXXXXXXXXX XXXXX XXXXXXXXXXXXX XXXXXXX
3.464   X XXXXXXXXXXX XXXXX XXXXXXXXXXXXX XXXXXXX
3.571   X XXXXXXXXXXX XXXXX XXXXXXXXXXXXXXXXXXXXX
4.000   XXXXXXXXXXXXX XXXXX XXXXXXXXXXXXXXXXXXXXX
4.255   XXXXXXXXXXXXX XXXXX XXXXXXXXXXXXXXXXXXXXX
4.257   XXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXX
4.261   XXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXX
5.382   XXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXX
5.687   XXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXX
6.071   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
7.215   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
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